PRODUCT VISUALIZATION AND SIMULATION

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Multimedia and Creative Technology

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APPROVAL

This Project titled **"Product Visualization and Simulation"**, submitted by Md. Harun Ar Rashid to the Department of Multimedia and Creative Technology, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Multimedia and Creative Technology and approved as to its style and contents. The presentation has been held on December 26, 2019.

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DECLARATION

I hereby declare that, this project has been done by me under the supervision of **Mr. Apurba Ghosh, Lecturer, Department of MCT** Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

The way to introduce a brand and / or its product to the consumer is an advertisement. Though it is challenging, with advertisement key features, usability, durability, look of products can be shown to consumers within the shortest time. Bad advertisement Irritate consumer with irrelevant and useless information which ruin the budget and time. Where simulation-based 3D visualization is one of the most popular and widely used technique to showcase a product. Nowadays consumer wants to have maximum knowledge about quality certification, advantages and disadvantages of a particular product before having this to make an appropriate choice for their need. The project is about to create a consumer convincible advertisement of a product “Ice-Cream”. Cinema 4D had been Used to create models and animation. Realflow | Cinema 4D 3 Plugin had been used to create the simulation part. In this visualization, an artistic visual representation of ice-cream production occurred that is able to please the consumer visually. This visual is able to engage the consumer with product efficiently and effectively without wasting valuable time. This visualization helps general mass to be aware of having a good product and its importance.

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CHAPTER 1

INTRODUCTION

This project is about to create a sample advertisement for a product “Ice-cream”. In advertisement time and look is important. Showing maximum attributes of a product within minimum time is the main challenge in the advertisement. In this case simulation is a great process to visualize fluid type products showing their features without spending a lot of time. That is why simulation is the key tool or process to visualize my idea. Analysis of several artist's works has helped me to determine what to do and what not. I have been encouraged by the artist’s great work and warned by their mistakes not to redo. I am inspired to materialize my idea with simulation techniques by several great artists around the world. It is a pleasure for me to mention those names from whom I am inspired. They are “Bloom” [1] created by Josh Clos [2] and Romain Faure [3], “Nars Orgasm Launch campaign” [4] created by Pablo Alferis [5], “Deliciously Viscous challenge” [6] created by Mario Hills.

I have chosen Cinema 4D as my main software for modeling, texturing, lighting, animation, and rendering. Realflow | Cinema 4D 3 plugin has used for simulation part of the project as it is lighter and faster than the whole program Realflow 10. Compatibility with Realflow plugin and easiest workflow helped me to choose Cinema 4D as my main 3D software for this project. Cinema 4D is also compatible with After Effect which is my editing and compositing software.

Several 3D software is there like Autodesk Maya, Autodesk 3D Studio Max, Blender 3D do the same job as Cinema 4D. But Cinema 4D serves the highest opportunity to a creator to create appealing motion graphics and dynamics with its efficient, self-explanatory, easier, user-Friendly, workflow. There is other software provide more crowding tools and function where I need some of them to create less detailed but visually pleasing output. And for this, I have chosen the Cinema 4D.

This project is aimed to create a good example of product visualization by simulation technique. Ice-cream of two flavor strawberry and chocolate will be visualized through the whole project.

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CHAPTER 2

LITERATURE REVIEW

2.1 Simulation

The word “Simulation” is a versatile word. This word is used to direct various phenomenon some of which related to computer graphics and some are not. So, what could be the definition of simulation? According Wikipedia the definition is “A simulation is an approximate imitation of the action of a process or system that represents its operation over time” [7]. Of course, I should simplify the definition but before that I want to discuss about the word “Imitation”. Again, according Wikipedia “Imitation is an advanced behavior whereby an individual observes and replicates another’s behavior”. Here researcher are observers and simulation are replicator which is created by the researcher to study about real phenomenon’s characteristics.

Now, it is the time to simplify the definition and that is “A simulation is proper mimicry of any process or system’s action that recreate or represents its action over time”. In simulation a replica of a system is created which may not be exist, accessible, acceptable, not yet built. And simulation is the solution here to study about inaccessible, unacceptable, nonexistence phenomenon. Examples may clarify the idea. In military training newbie pilots are trained up by simulation system which replicate situation, environment, and difficulties of real-time air-travel. Though the system is costly but not more than a life. In simulation system a newbie pilot faces all real-time difficulties as a result the pilot become able to handle the real situation. This process reduces the cost and risk. Weather specialist try to simulate the path which the storm may follow according the characteristics of a storm to save people and property. Sport analyst try to simulate the result of a game according statistics of player performance to plan properly against opposite team. An engineer designs a circuit flow according given data with the help of simulation technique before it actually introduced or produced for consumer use.

It is really hard to classify the use of simulation. As a student of multimedia, I can simplify the classification from my point of view. A hierarchy will show the classification and that is:

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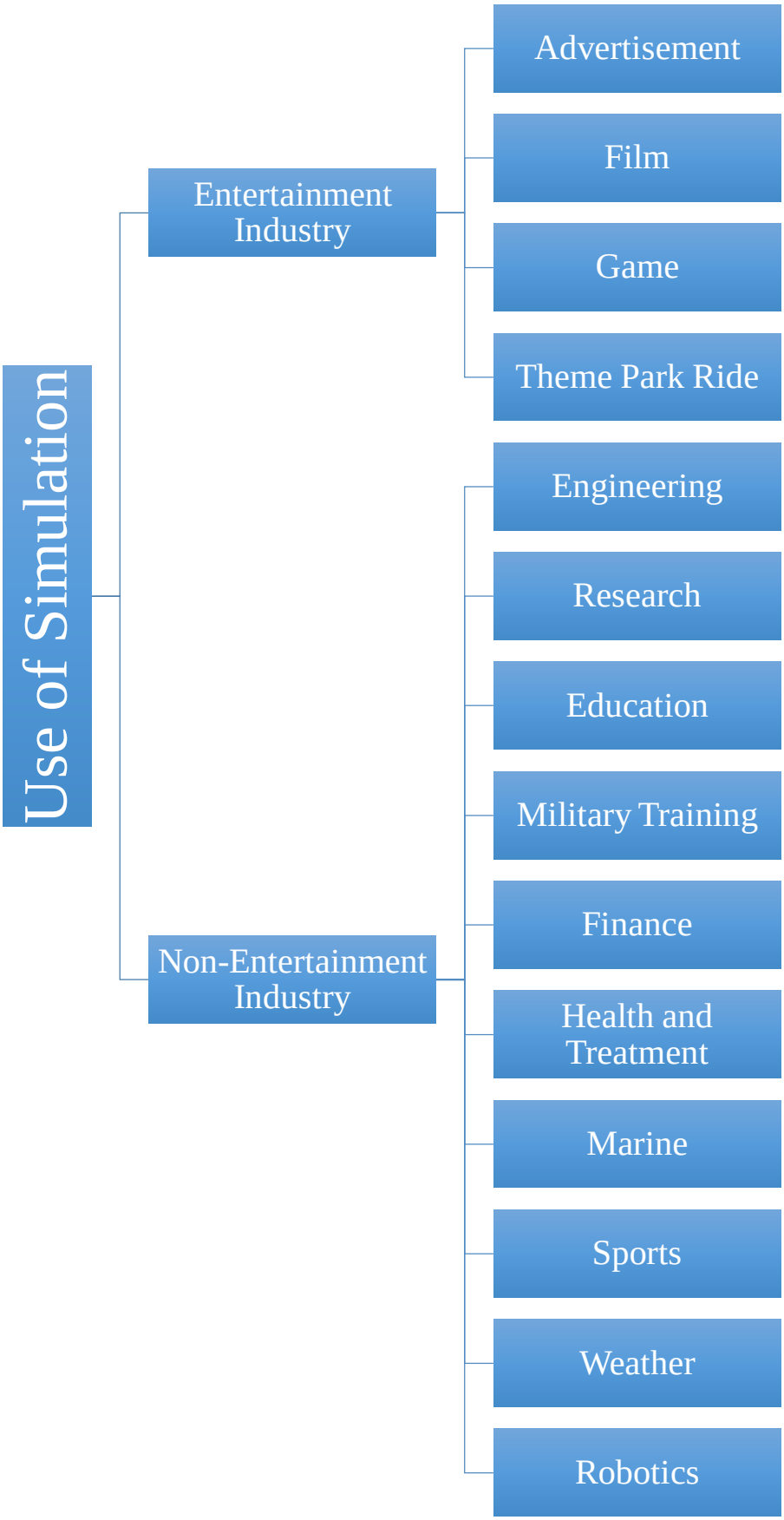

Figure 2.1: Use of Simulation

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2.1.1 Simulation in Entertainment Industry

Simulation is being used in the entertainment industry since 1947 with the journey of a missile target simulation game. Then several feature films started adding virtual characters or creatures along with real footage with the help of simulation to create the unseen virtually real. Again, we can classify further to clarify the idea and these are:

2.1.1.1 Simulation in Advertisement

A little research on several types of visualization from artists of home and abroad help me to determine the way I want my project to be ready. Their great job inspired me to do better and mistakes warned me to avoid them and these are:

"Nars Orgasm launch campaign" [8] from playful by Pablo Alferi is a great piece of art. In this launching campaign featuring film artist show the arrival of the orgasm collection of Nars. The visualization of orgasm series of cosmetic products is a combination of great color, motion, and simulation. There is a lot to learn from the elegant piece of visualization. Composition of this visualization directs my eyes to go on with its smooth motion of simulation with appealing color.

"Gummy Vapormax" [9] is a personal project by fanny rollot and verd baker to represent Nike's Vapormax Sneakers. This piece of visualization successfully describes the key features of Nike's vapormax sneakers by its elastic twist and motion done by rigidbody and elastic types object simulation with playful color and music.

"Bloom" [10] is a vignette about life and beauty. Bloom was created by Romain Faure, Josh Clos, Cristina Barna, and Alec Considine-Mueller. It's a great work to learn composition, lighting, simulation, animation. It tells a story to us with visual beauty by simulation and animation. Polar ice cream TVC [11] is a great example of the use of fluid simulation in Bangladesh. Salt 'Everything's Better' [12] by Gentleman Scholar is a great example of simulation. A motion design done by Paulo Wang [13] is colorful fluid simulation.

2.1.1.2 Simulation in Film

Jurassic world [14], Moana, Avatar [15] these names maybe the best example of simulation. Fluid simulation [16], hair simulation [17], cloth simulation [18], physics

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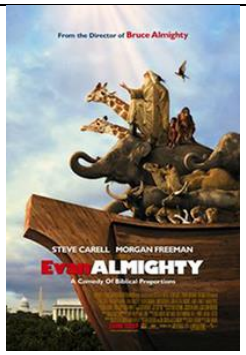
simulation gave these movies an ultra-realistic look. Simulation. Some example of using simulation in film given below:

Table 2.1: Use of Simulation in Film

No	Movie Name	Release Year	Poster
1	Poseidon [19]	2006	
2	Pirates of the Caribbean: Dead Man's Chest [20]	2006	
3	Evan Almighty [21]	2007	
4	Moana	2016	

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5	Avatar	2009	

2.1.1.3 Simulation in Game

In simulation games real environment, action, tools are replicated approximately to provide an actual feel to the player. Simulation games are more complex than other video games as it mimics the interaction between character and environment realistically. People play thee simulation games not only to spend time and entertained but also to have knowledge and experience which they cannot afford in real life. Example: "X Plane 11" is a flight simulator game where the player gets the actual flavor of plane driving with numerous control and function. Game analyst plays football manager to determine the probable position set of the players in the field. Day by day simulation games are becoming more and more popular. Here, I am going to mention name of some famous simulation games:

i. Farming Simulator 18
ii. Eurotruck Simulator 2
iii. Asseto Carsa
iv. X Plane 11
v. Pc building simulator
vi. Train Simulator
vii. Football Simulator
viii. Cities: Skylines
ix. American Truck Simulator
x. SimCity
xi. Firefighting Simulator
xii. Microsoft Flight Simulator

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2.1.1.4 Simulation in Theme Park Ride

Simulator rides are lighter edition of military and commercial simulator. Although they both have many similarities but they are different by working process. Military training simulator works according the command of newbie pilot but ride simulator works according prerecorded potion path.

"Link Trainer" [22] is the very first simulator ride for training in 1930. Production houses had delivered some ride simulator for movie lover people. These simulators are "Star Tours" [23] by Disney in 1987, "Fantastic World of Hanna "Barbera" [24] by Universal in 1990. Physical effect like water spray, scents have increased its demand.

2.1.2 Simulation for Non-Entertainment Industry

There are so many industries where simulation process is used to study, explore new characteristics of system that is recreated virtually by simulation. Researcher tries to replicate a natural phenomenon to study about a particular topic in depth by the help os simulation. We can clarify this understanding far better with what David Holman, Head of Xflow Technology said, "Simulation has different phases in the context of engineering. Simulation tries to predict in the most accurate way or reality it behaves. Computational simulation as an engineering tool is reliable alternative to experimental analysis such as Wind Tunnel Analysis. Simulation provides valuable insight into the performance of an aircraft or ground transportation vehicle. And what's more the computational approach usually offers a better flexibility than the experiment more insight into the details and saves time and money. So sometimes computational simulation is the only way to get an answer".

2.1.2.1 Engineering

2.1.2.2 Research

2.1.2.3 Education

2.1.2.4 Military training

2.1.2.5 Finance

2.1.2.6 Health and Treatment

2.1.2.7 Sports

2.1.2.8 Weather

2.1.2.9 Robotics

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2.2 History of Simulation in Entertainment Industry

Missile firing game created by Thomas t., Thomas jr. and Estle Ray Mann in 1947. This may be the first simulation game. This game was about to hit a target with a missile where path curve and speed of missile controlled by knobes. Willy Higginbotham introduced a multiplayer tennis game in 1958 called "Tennis for Two" [25]. Where two players could play with a big hand controller. An oscilloscope was used as a display. "Battle zone" [26] a tank combat game by Atari and "Elite" [27] by Acornsoft were one of the first computer games for home computers. In the Battle zone accurate fire path designed by simulation technique. Study on real missile curve path, tangent, slop turns into mathematical model which then converted to programming language and final result is the accurate missile path curve.

Figure 2.2: “Tennis for Two” game Controller

The computer had become more cost-efficient and faster with the advancement of technology. Cost-efficiency had increased the number of home computer user rapidly that time. And with the increasing number of computer user many types of games were introduced that time. This era of computing introduced Xbox gaming. A bestselling video game console named “Nintendo Entertainment System” by Nintendo had boost up the use of console gaming in 1985. “The Sims” [28] and “Command and conquer” [29] such games created their identity with vast popularity. Today simulation games like “World of Warcraft” achieved a higher position worldwide.

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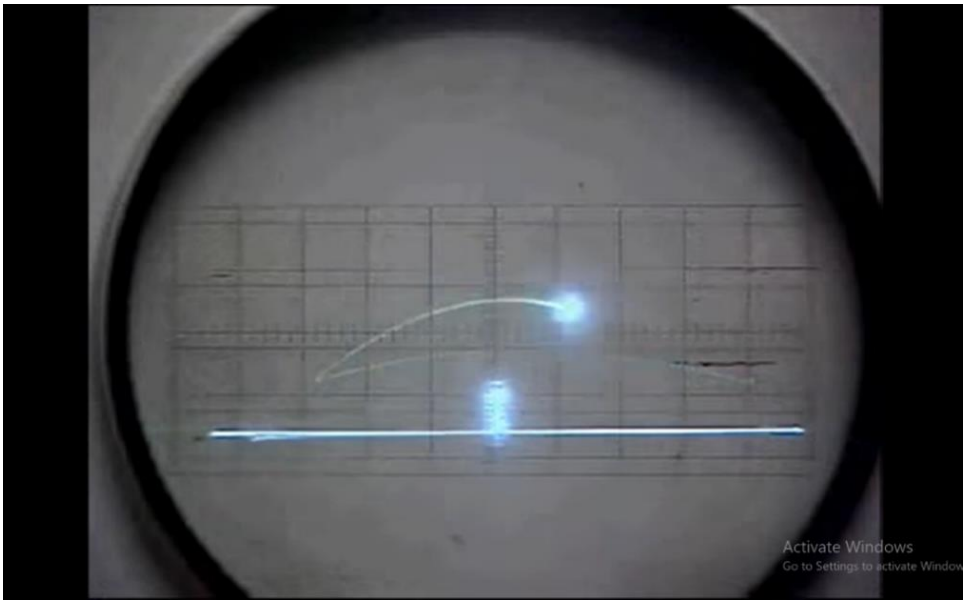

Figure 2.3: “Tennis for Two” Game Display

"Tron" [30] is the name of the first CGI film where computer-generated imagery used for minutes. Simulated dinosaurs had been combined with live footage to provide a realistic look in the film called "Jurassic Park" [31]. “Toy Story” [32] is the first fully animated feature film. Physics based simulation was the key technique to bring the animation to life in 1995. It was the beginning of CG world. People showed their interest to the realistic animated film which gave them a new experience with impossible things in the screen. This interest of viewers inspired the production houses to create next one.

Virtual cinematography created infinite possibilities in the animation film industry. Simulated virtual character and creature added to real footage with really impossible camera movement which gave dynamic look to CG film. “Matrix” [33] and “The Lord of the Rings (Film Series)” [34] are some examples here.

2.3 Contribution of Scientist and Mathematician in simulation

Finding someone who don’t like to watch blockbuster films with great surrounding sound is hard when he or she has got the flavor of that thrilling feel at least once. Maybe few of us think about the science and math behind the blockbuster films those creates unseen, thrilling, surprising visual effect, simulation and animation possible. Scientists and mathematicians work day and night to find out the formula or mathematical model

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which will be translated to realistic simulation. Process of converting a natural phenomenon to a realistic simulation can be described with an interview of Angel Tena, Head of Realflow Technology and David Holman, Head of Xflow Technology. Angel Tena said "Simulation is the process of imitating or mimicry reality. We first observe reality, we are able to build a mathematical model from that reality. Those mathematical model translated to algorithms that we can program so that the computers finally are able to do what reality is". David Holman said "We are inspired by reallife but all scientist interprets underline behavior of physical phenomena naturally in mathematical way". Contribution of three renowned scientist, researcher and mathematician in simulation sector of computer graphics described below.

2.3.1 Duncan Brinsmead [35]

Duncan Brinsmead is a self-taught softer programmer and developer. He works for simulation on natural phenomena. He started his career as a softer developer in former "Alias System Corporation" and today's Autodesk. He worked with Autodesk on Maya to enable the user to paint hair and plants on the 3D surface in 2008. He also worked for Terra Forma, Power Animator and Maya software. He promoted to "Principal Scientist" at Autodesk and by his sole contribution Autodesk user get introduced with Maya Paint Effect, Maya Hair and Maya Toon. These tools now upgraded to nHair, nCloth for simulating cloth and hair. Recently he has worked for "Dynamic Solver Framework". Tools developed by him have been used in several world-famous film industries and special effect houses like Disney, Industrial Light and Magic, Pixar, Dreamworks and Weta. In innumerable movies his techniques and tools have been used such as Toy Story, Shrek, Spiderman and Alice in Wonderland.

2.3.2 Jos Stam [36]

Jos Stam is a researcher on physics-based simulation of natural affairs. His several works have created a new horizon in the simulation of fluid and gases. He has created a bridge between two modeling styles NURBS and Polygon Modeling by introducing the subdivision surface.

He started his career in Alias | Wavefront division of SGI. He worked for a particle system for a software package called "Power Animator" and Maya's fluid simulation.

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Jos Stam promoted as “Senior Research scientist” at Autodesk when Alias owned by Autodesk in 2006.

Jos Stam was awarded with “SIGGRAPH Computer Graphics Achievement Award (2005)” for the contribution on computer graphics sector, “Academy Award for Technical Achievement (2005)” for contributing on “Subdivision Surface”, “Academy Award for Technical Achievement (2008)” for his creation of fluid effect system for Maya.

2.3.3 Ronald Paul “Ron” Fedkiw [37]

Ronald Paul “Ron” Fedkiw is a full professor of computer science at Stanford University. He is also a leading researcher in the sector of computer graphics and his research is focused on physics-based simulation on the basis of natural phenomena. He is also passionate about machine learning.

Fedkiw’s works on simulation made the artist able to create a more amazing water effect. His research and technique make possible the rendering of the sea of pirates’ movies (Pirates of the Caribbean movie series) and fire breath of dragons of “Harry Potter and the Goblet of Fire”. Artists made the rushing floodwater in “Evan Almighty” by using fedkiw’s technique. Fedkiw chose “Poseidon” as the best use of his technique for the sinking scene of the ship.

“Particle Level Set Method” introduced by fedkiw’s team by which smoother surface of water and breakdown of seawater waves can be created. He and his co-worker created a C++ code library for creating physics-based modeling which will help to produce better special effects with water, smoke, fire, cloth, rigid body and deformable body simulation.

Two movies in those his technique was used nominated for 79th Academy Awards. One is “Pirates of the Caribbean: Dead Man’s Chest” won the Academy Award for visual effects especially for the tentacles of the character Davy Jones. Another is “Poseidon” which was also nominated that year in the same category for Academy Award.

In 2008, Fedkiw achieved the 80th Academy Award for Technical Achievement in the category of “Academy Scientific and Technical Award” for developing a fluid

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simulation system for Industrial Light and Magic Company. He received his second "Academy Scientific and Technical Award" for the contribution to the destruction system for ILM PhyBAM.

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CHAPTER 3

3D MODELING AND TEXTURING

In this section modeling, texturing and material creation process will be described successively. Software, tools, techniques and process has been discussed here to present my workflow for this visualization.

3.1 Strawberry

Strawberry is a crucial model in my project of ice-cream advertisement. Generally, a strawberry has three parts of its fruit body. They are green calyx, red body, and reddish yellow seeds.

3.1.1 Calyx

Calyx is the upper green part of the strawberry which holds the juicy fruit body. It is also called hull or cap. It connects the fruit body with its stem.

Modeling

Step 1: Viewport > Option > Config > Back > Image > Browsed and Imported image.

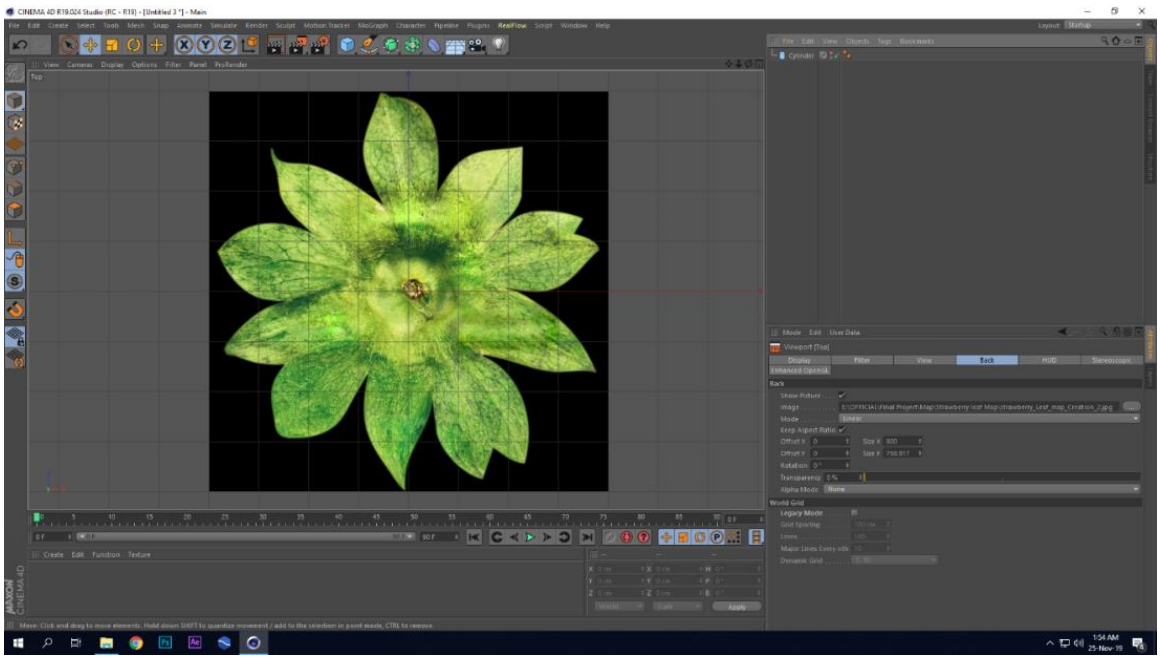

Figure 3.1: Reference image for Calyx

© Daffodil International University

Step 2: Nine rotational segmented cylinder was chosen and made editable.

Step 3: Extruded every outer edge keeping 6-7 subdivision with group unchecked.

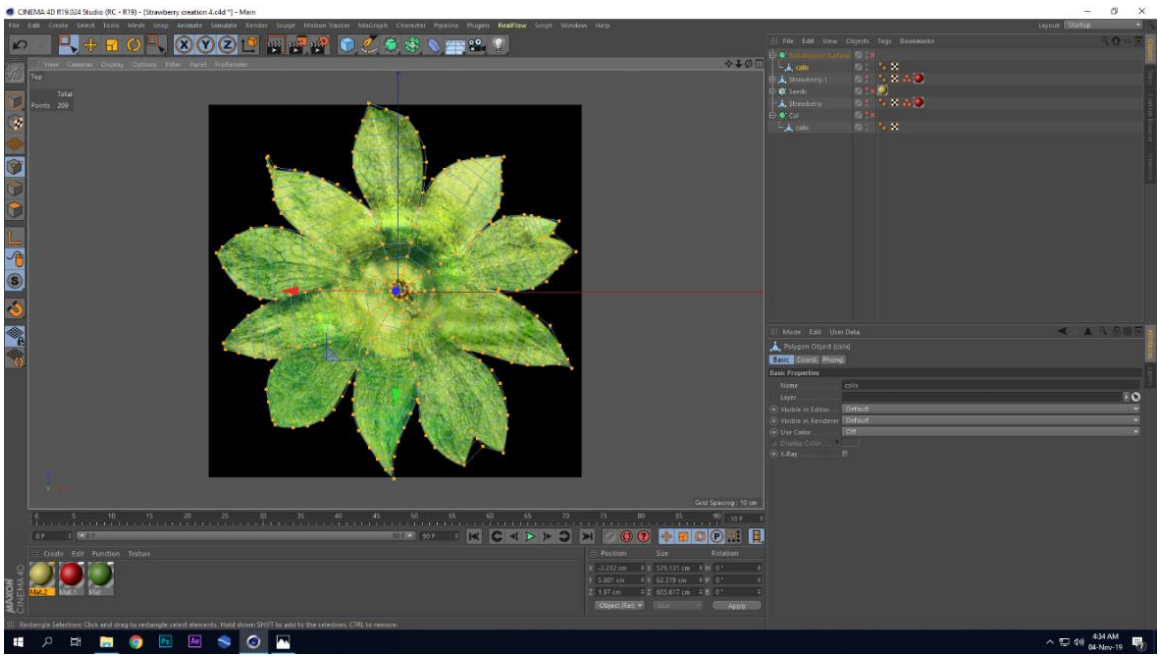

Figure 3.2: Calyx Shape by Cylinder Object

Step 4: Made the calyx curly to give more naturalism. Deleted the central faces and extruded the created holes edges to create a tube shape for stem.

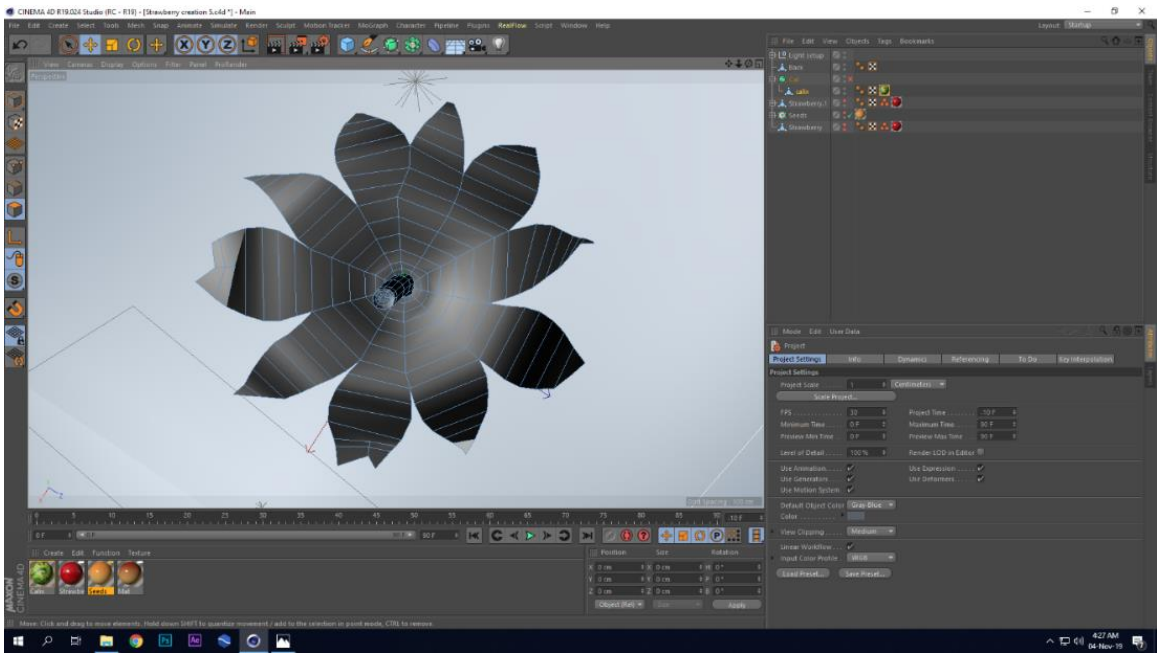

Figure 3.3: Calyx Model

© Daffodil International University

Step 5: Finally applied subdivide function to smoothen the shape.

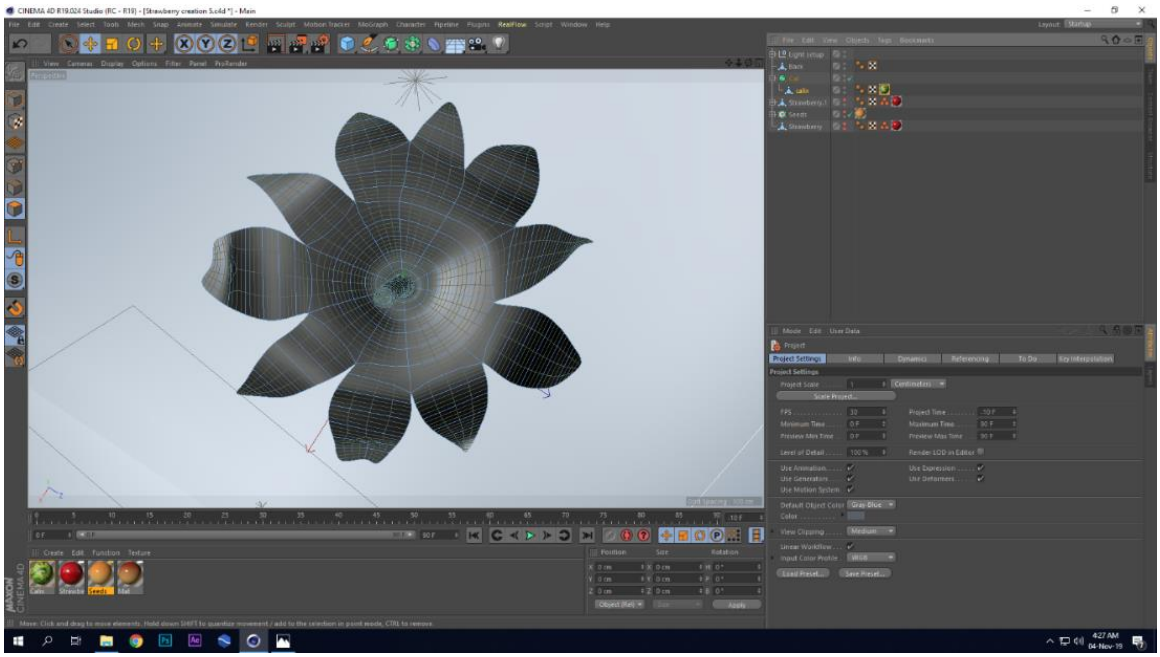

Figure 3.4: Subdivision Applied on Calyx Mode

Texturing:

Step 1: I had changed the layout from startup to UV-Editor. First of all, I had applied the frontal projection from top view which gave me the UV mesh of calyx properly.

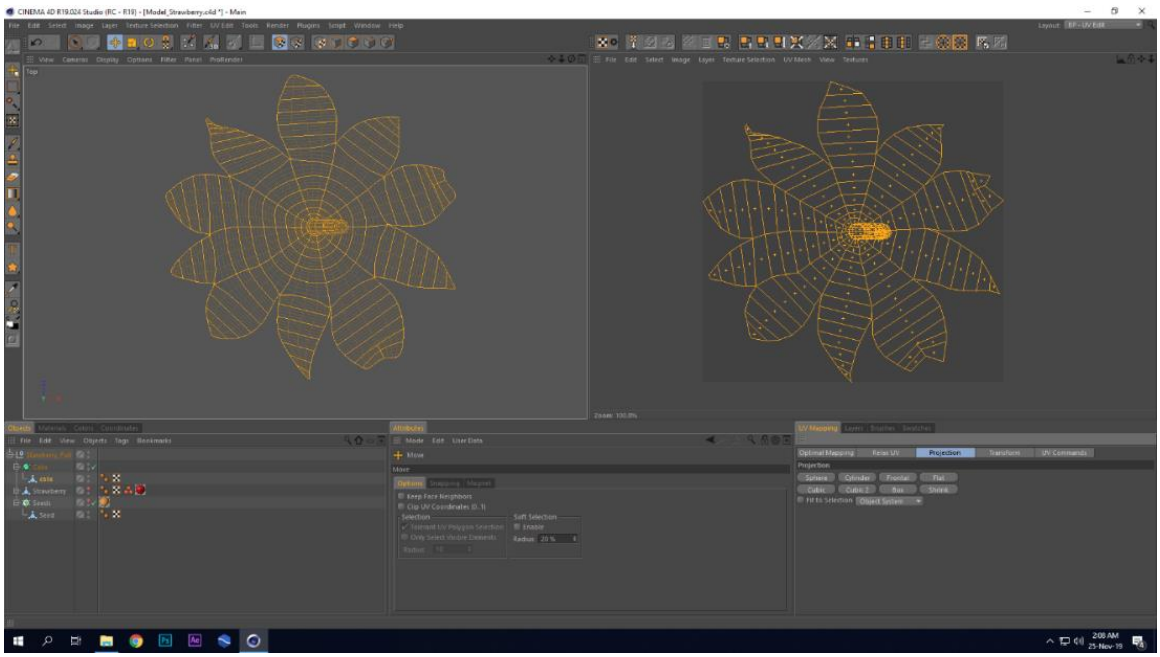

Figure 3.5: Frontal Projection on Calyx Model

© Daffodil International University

Step 2: Stem was unwrapped from the calyx. Keep checking the cut edge down option “LSCM” relax mode had been applied. Then unwrap the stem part as UV mesh.

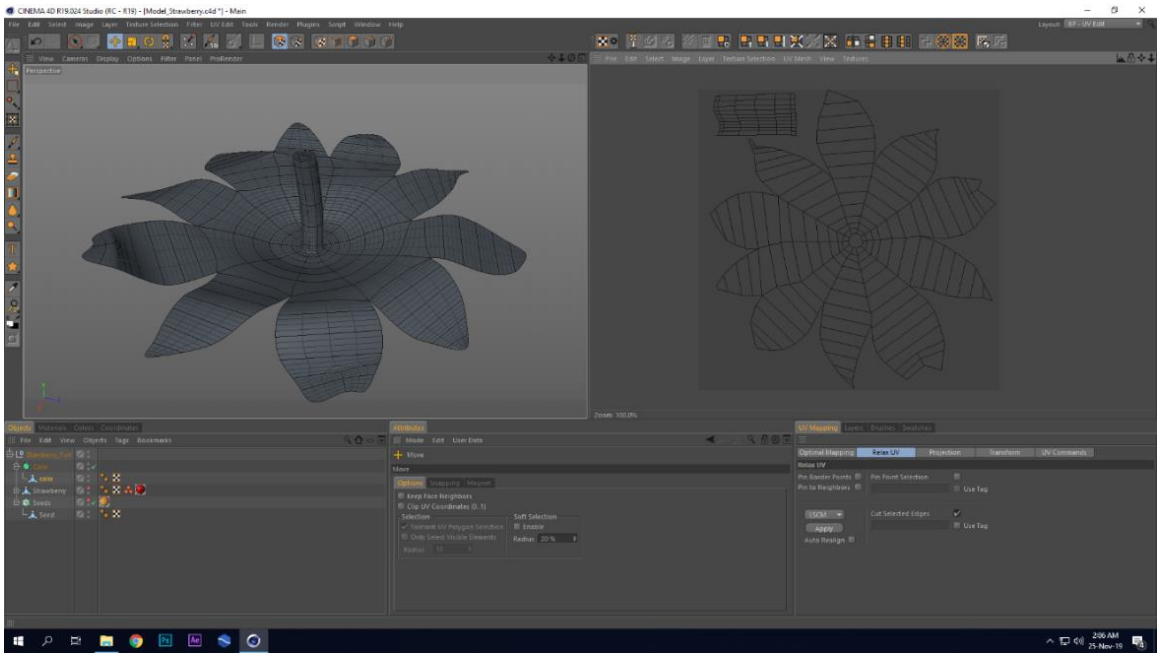

Figure 3.6: Stem Unwrapped from Calyx

Step 3: I had also unwrapped the top cap part of the stem by going through the same process for more precision.

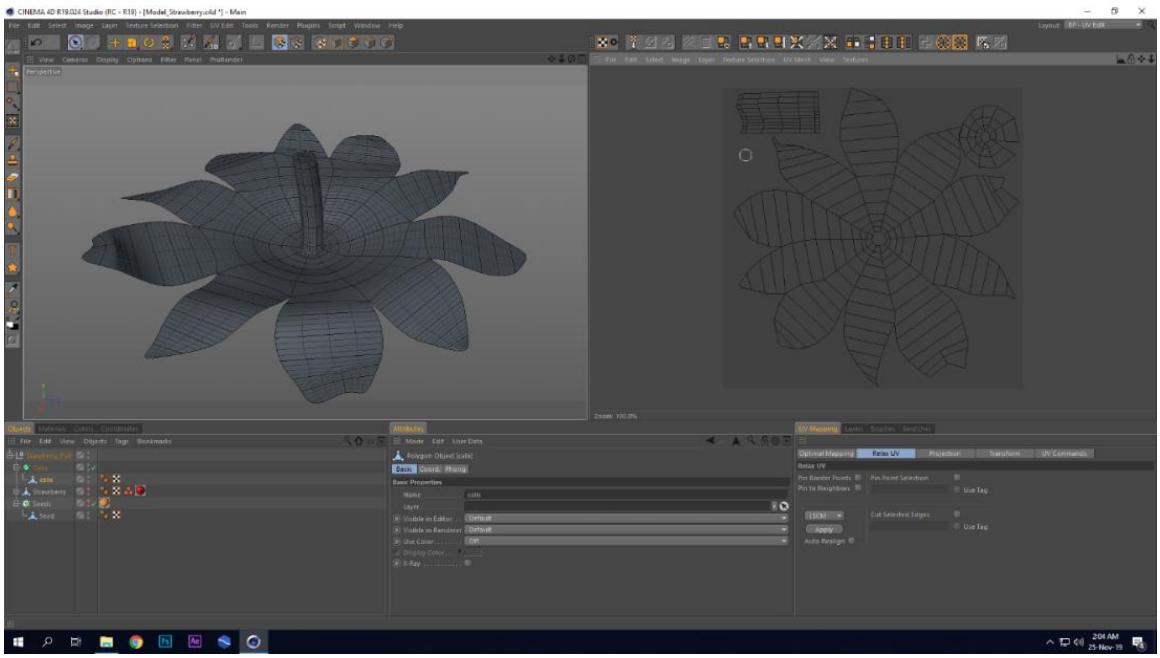

Figure 3.7: Cap of Stem Unwrapped from Calyx

© Daffodil International University

Step 4: I took a layer and then Going to option from the layer panel I took a separate red fill layer beneath the UV mesh layer to make the UV outlines more visible.

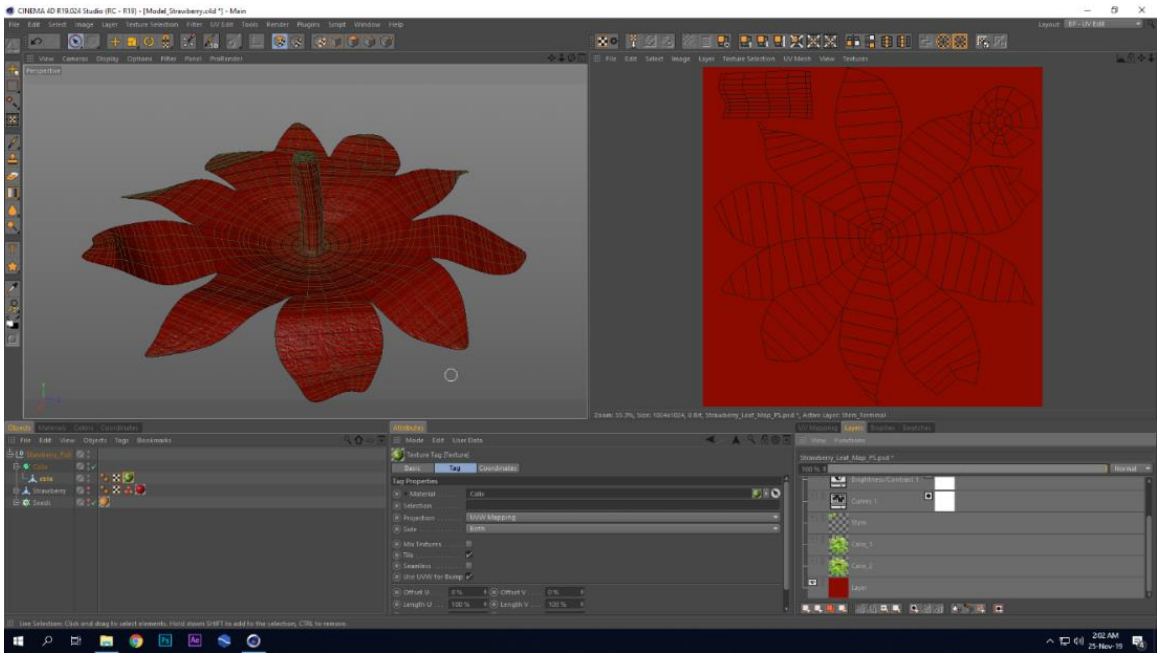

Figure 3.8: Red Fill Layer under UV Mesh Layer

Step 5: Exported PSD file. In Photoshop, I had separated the calyx and made chunks for calyx, stem and others. Part of same image had been used to create the textures for parts.

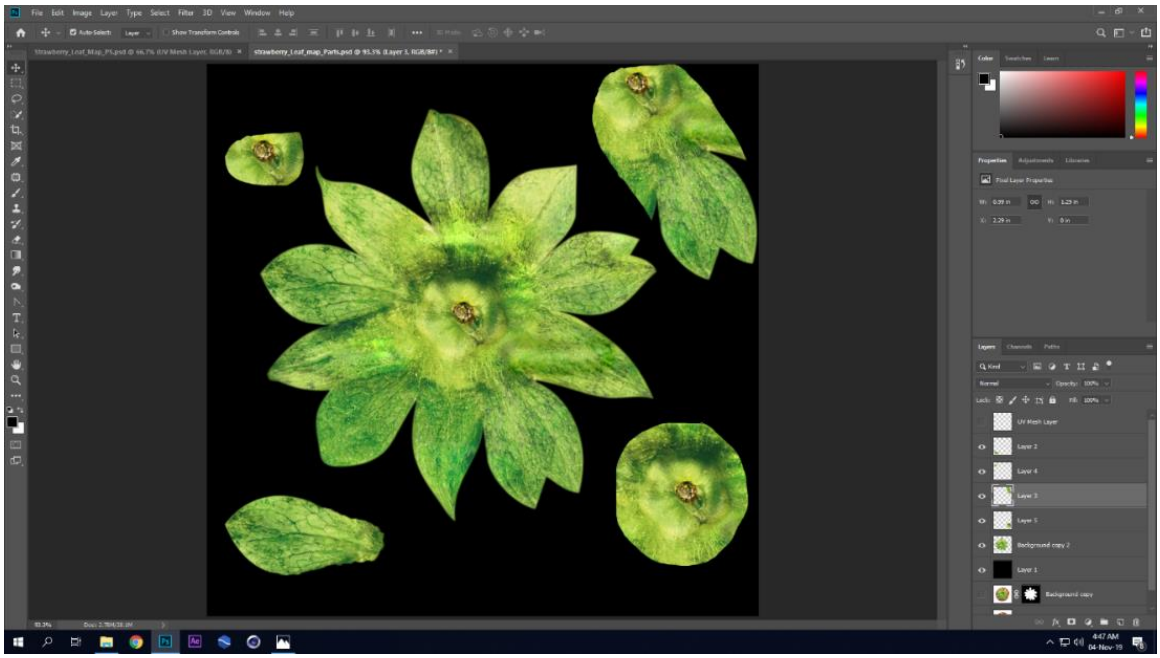

Figure 3.9: Chunk of Calyx Texture in Photoshop

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Step 6: Made the chunks fit under the UV outline by positioning, wrapping and rotation. Saved the file in Photoshop and reopen it in UV layer panel.

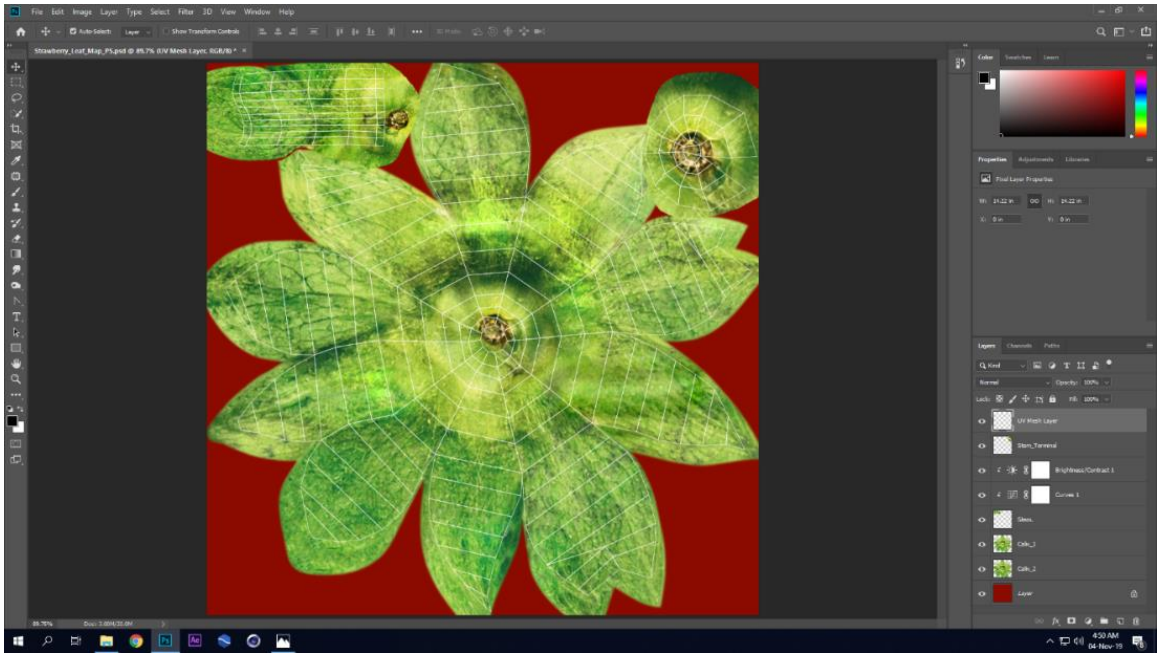

Figure 3.10: Fit the Texture under UV Mesh Layer

Step 7: Finally applied the texture by a material on the calyx model. Fine-tuned the texture, finding gap and going to Photoshop to readjust the texture according the UV.

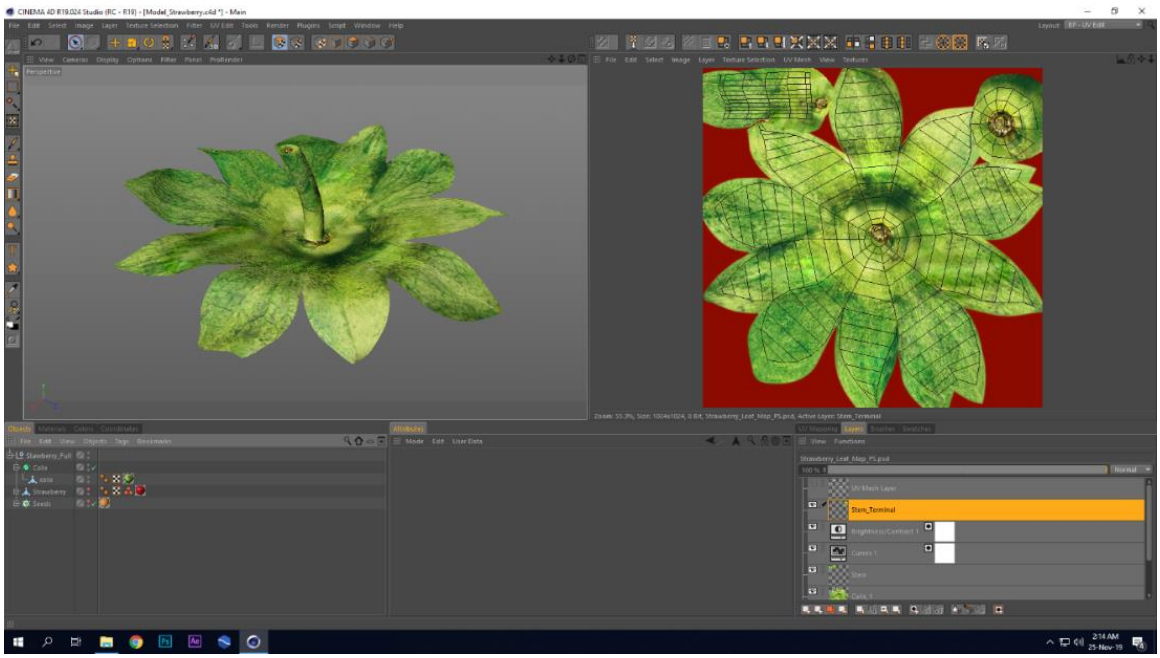

Figure 3.11: Finalize the calyx texture

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3.1.2 Body

Red fruit body is the main visual and attractive part for the strawberry model. It is important because it holds the other parts of a strawberry. Calyx starts from its wider side and seeds remain on red fruit body of the strawberry. It is the most complex modeling part of the strawberry model for the creation of notches for seeds. Several trial and error process happened during the creation of the model. First of all, strawberry model was created from a sphere but it was painful to create asymmetrical notches over the model to hold the seeds. Here, a sphere type called “Icosahedron” made possible the idea of asymmetrical notches by its form.

Modeling

Step 1: Going to front and right Viewport > Option > Config > Back (Chosen from attribute manager) > Image > browsed and imported image.

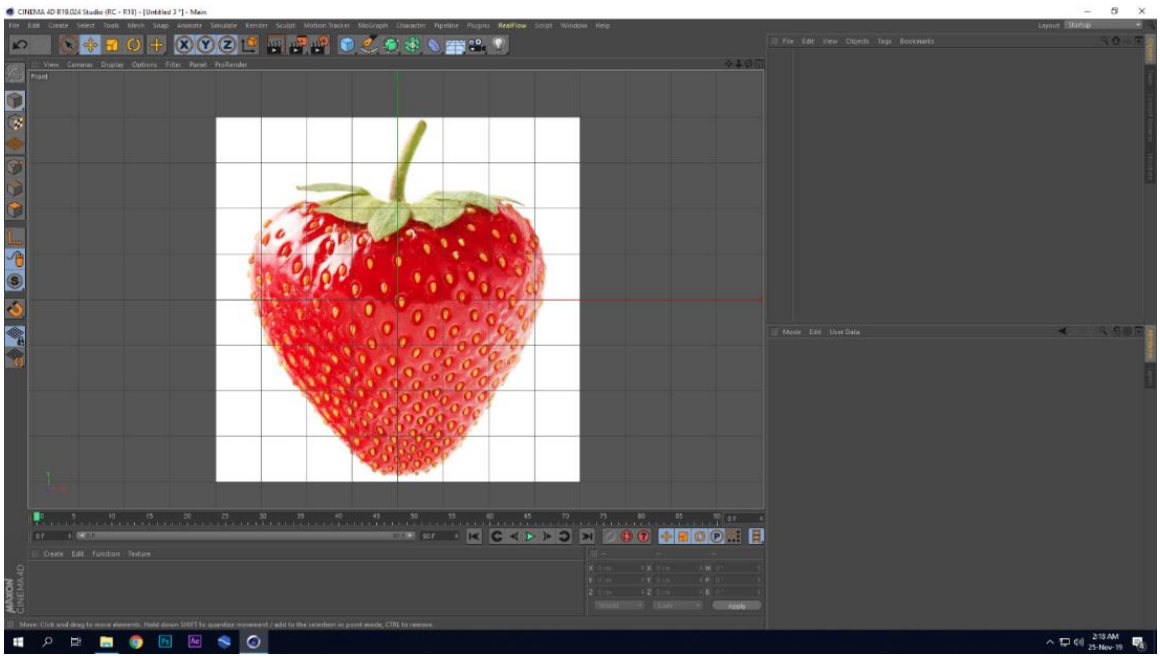

Figure 3.12: Reference Image for Strawberry

Step 2: From the create menu a sphere object had been chosen. Type had been changed to icosahedron to hold the seeds on the vertices asymmetrically. Radius value was 100cm and segment was increased to 36 to get smoother model. Icosahedron is the only sphere type with which proper strawberry body model can be created and the seeds over the body can be placed asymmetrically what was expected.

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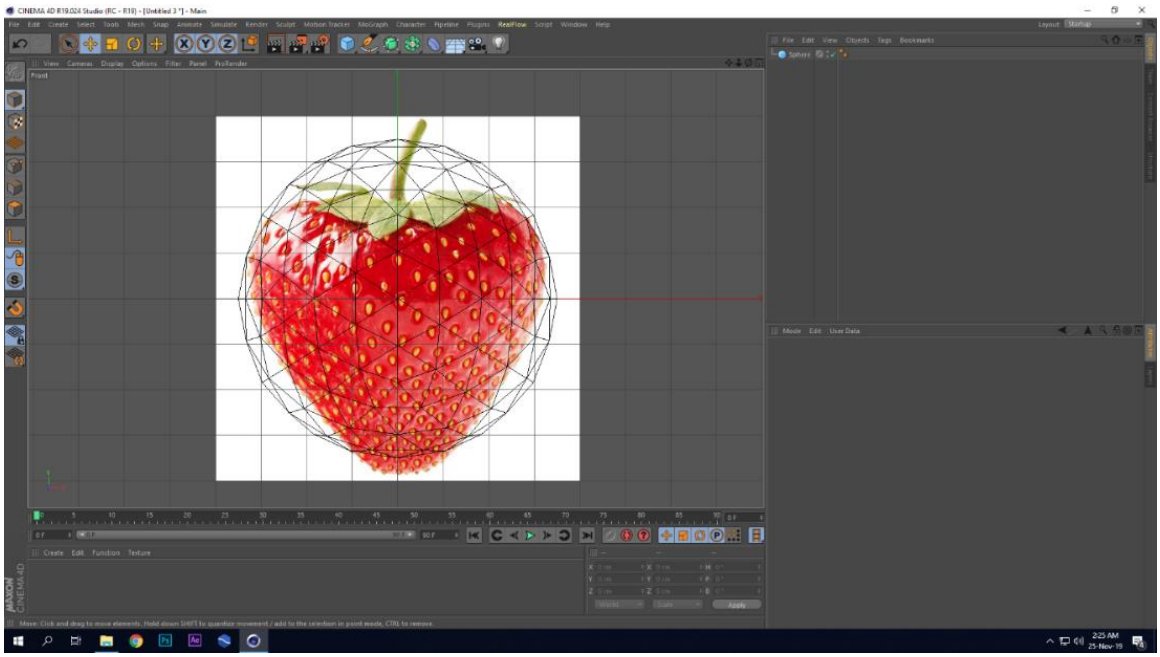

Figure 3.13: Icosahedron Sphere to Model Strawberry

Step 3: According reference point's position was transformed properly from the side and front viewport. Subdivision function was added to the sphere object to smoothen the shape.

Step 4: "FFD" Deformer added for precision by deforming slightly the model.

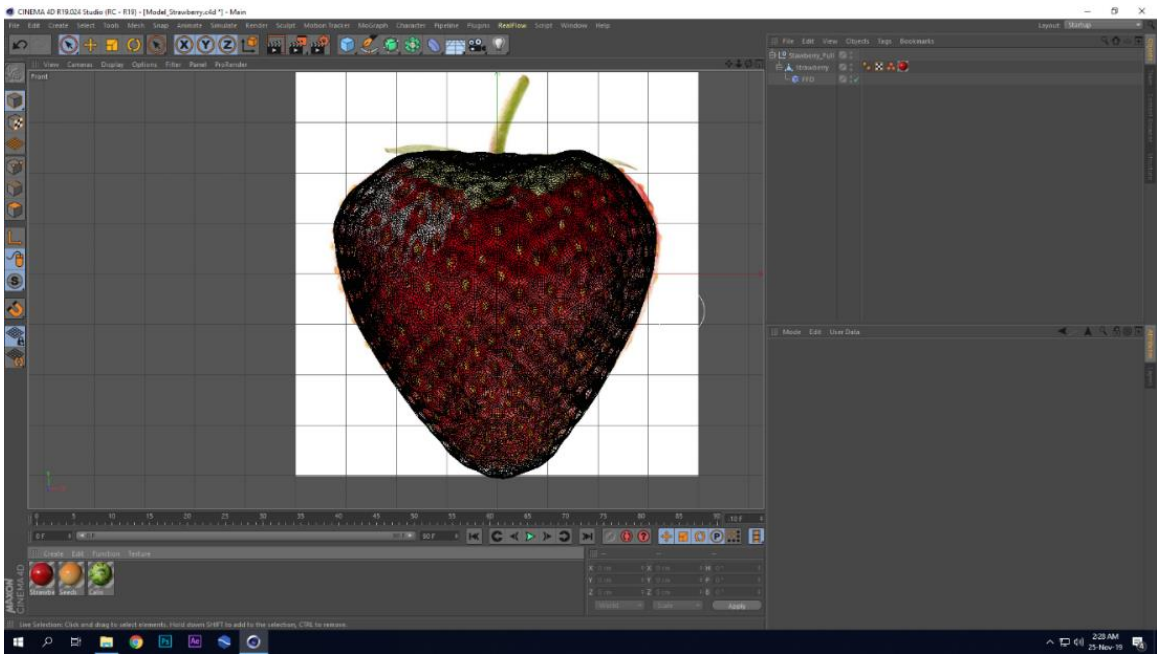

Figure 3.14: "FFD" Deformer Applied to strawberry Model

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Material

Step 1: Red color was chosen from the reference image by eye dropper tool in color channel.

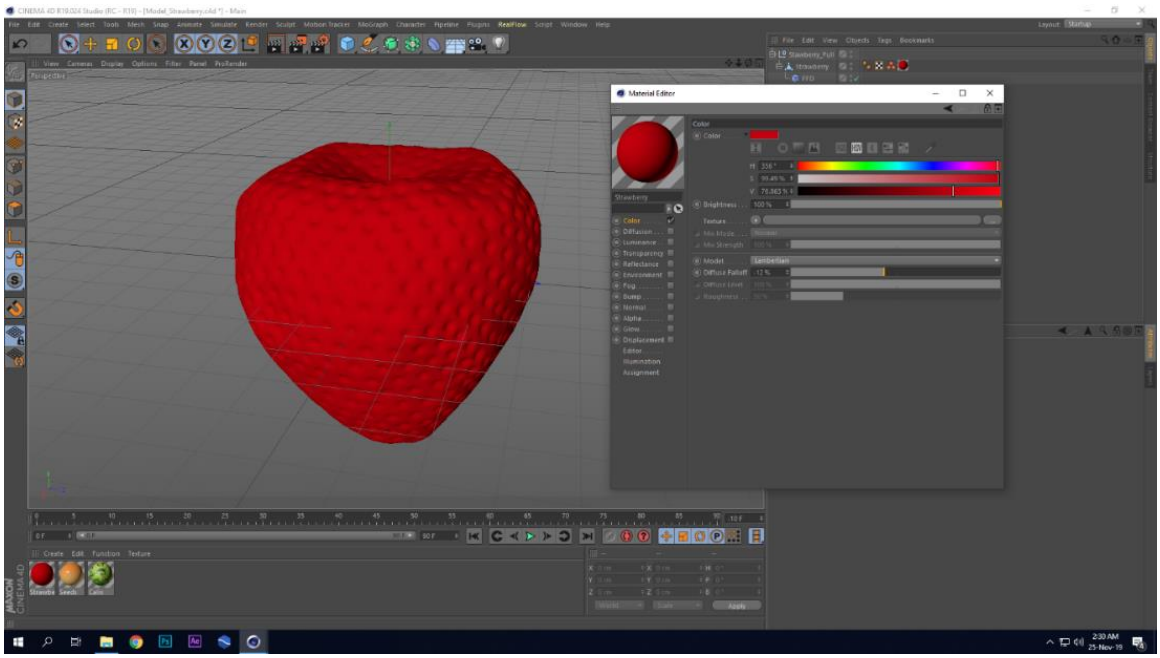

Figure 3.15: Color Channel on Strawberry Model

Step 2: In reflectance “GGX” was chosen with proper specular strength and width.

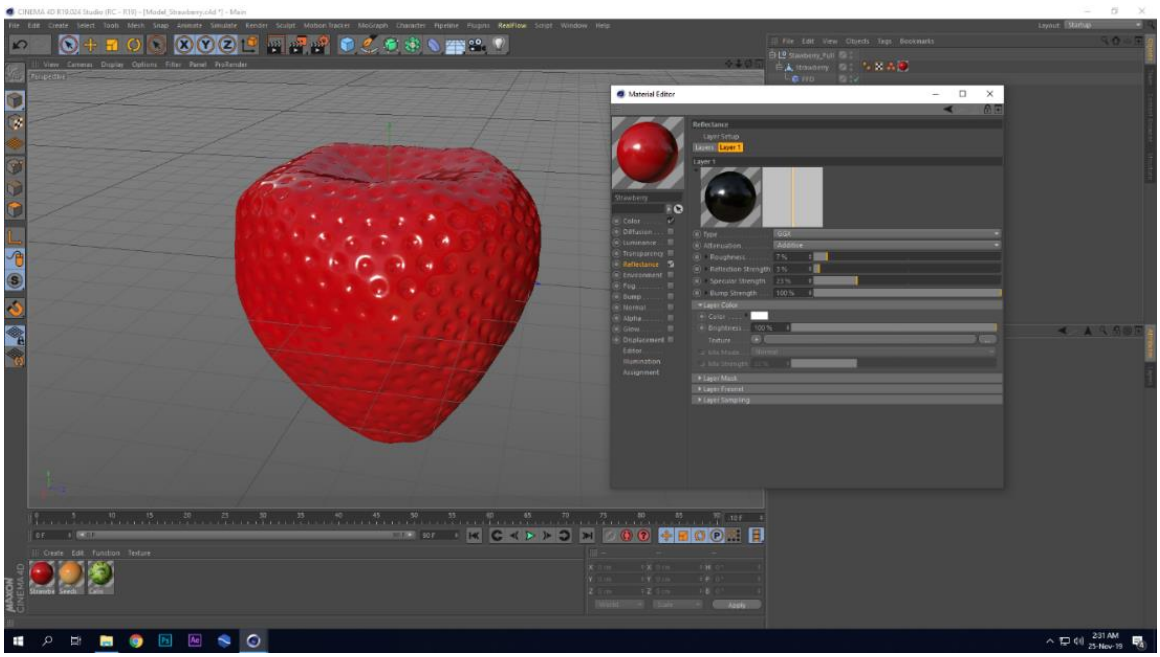

Figure 3.16: Reflectance channel on strawberry model

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3.1.3 Seeds

"Achene" is the actual name. These seeds are actually ovals that hold seeds inside them. Actually, these so-called seeds are the main fruit body of strawberry according biological definition. But "Achene" does not create the juicy eatable fruit part. General mass called it seeds for its small size and position. It was the simplest model of the project.

Modeling

Step 1: Seeds were made from sphere object and the places over the strawberry model to hold the seeds were made by scaling down all the strawberry models' vertices towards inside.

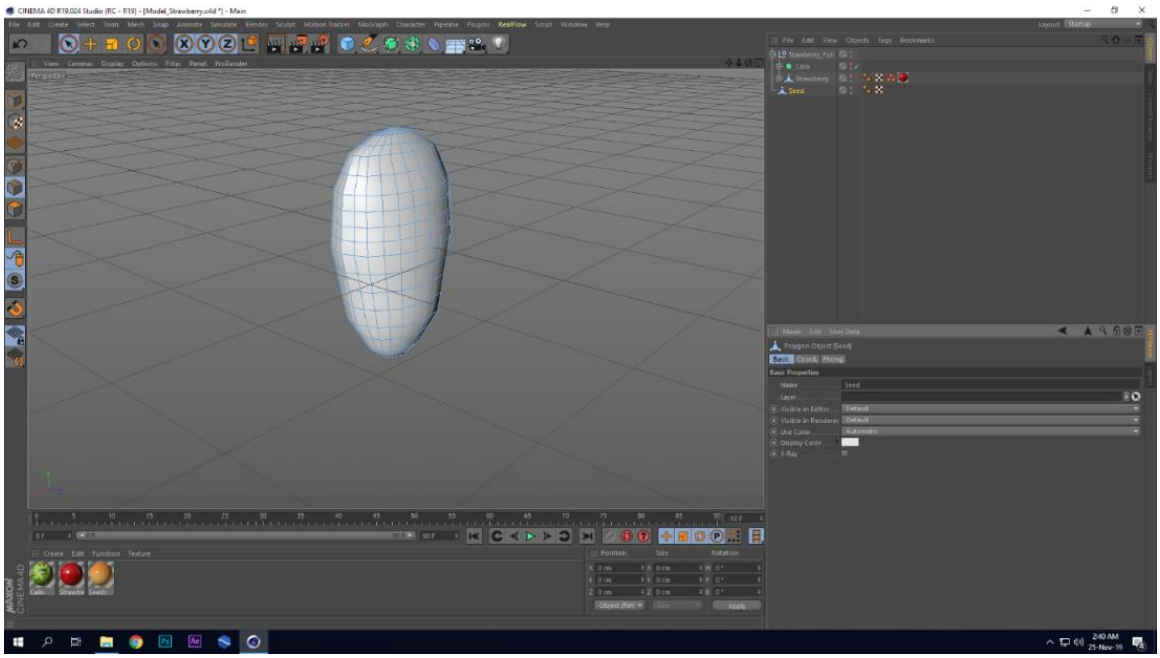

Figure 3.17: Strawberry Seed Model

Step 2: Mograph cloner was used to clone the seeds. object mode was selected to clone the seeds over the strawberry model on each point. Strawberry was linked with the object option. By selecting all the points set selection command was applied to have a section tag of all point. The point selection tag then linked to the selection option. Distribution option set to vertex to clone the seeds to every vertex point. To hold the seeds vertically aligned along the model surface vector was chosen to positive Y axis "Y+". Minor positioning of seeds was happened for the deformed strawberry model.

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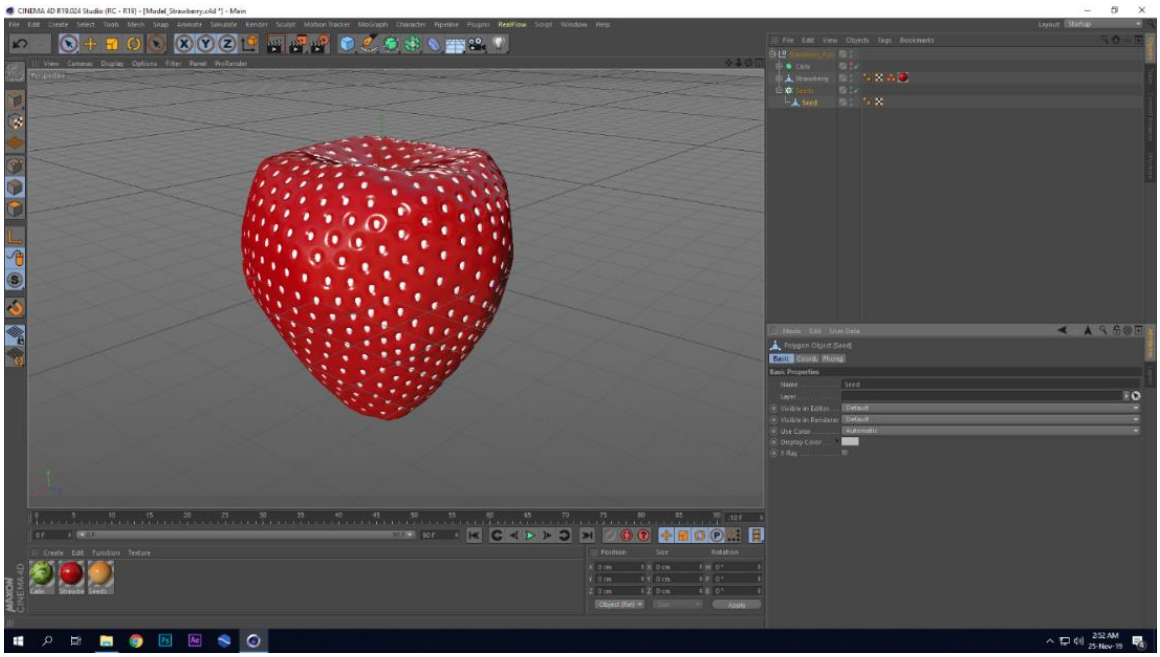

Figure 3.18: Seeds Placed on Strawberry

Material

Step 1: In color channel a gradient used to mimic the real color of the seeds. Gradient of yellow and red color was used for the seeds. Gradient projection type was 2D-U to set the direction of colors. In gradient shader option turbulence set to 15%, octaves to 6, scale to 180%, seed to 7, angle to 270 so that irregular color transition happened on the seeds surface.

Step 2: In the reflectance channel "GGX" reflection preset was used to make the seeds less reflective. Roughness value was set to 10%, reflection strength to 4% and specular strength to 5% bump strength 100% to have minimal reflection, tiny specular highlight and irregularity in reflection to mimic the organic micro bumpy surface. These ensure the minimum fine tuning and its feedback is maximum realism.

Step 3: Same gradient was also used in the luminance channel so that emission of light will be according the brightness of color. Brightness of the luminance channel was set to 5%. Gradient shader was mixed to the luminance channel with normal mode by 5% mix strength. Upper minimum portion is reddish and lower maximum portion is yellowish though the red color rarely seen. Though it is small model all action was taken to give this a realistic look.

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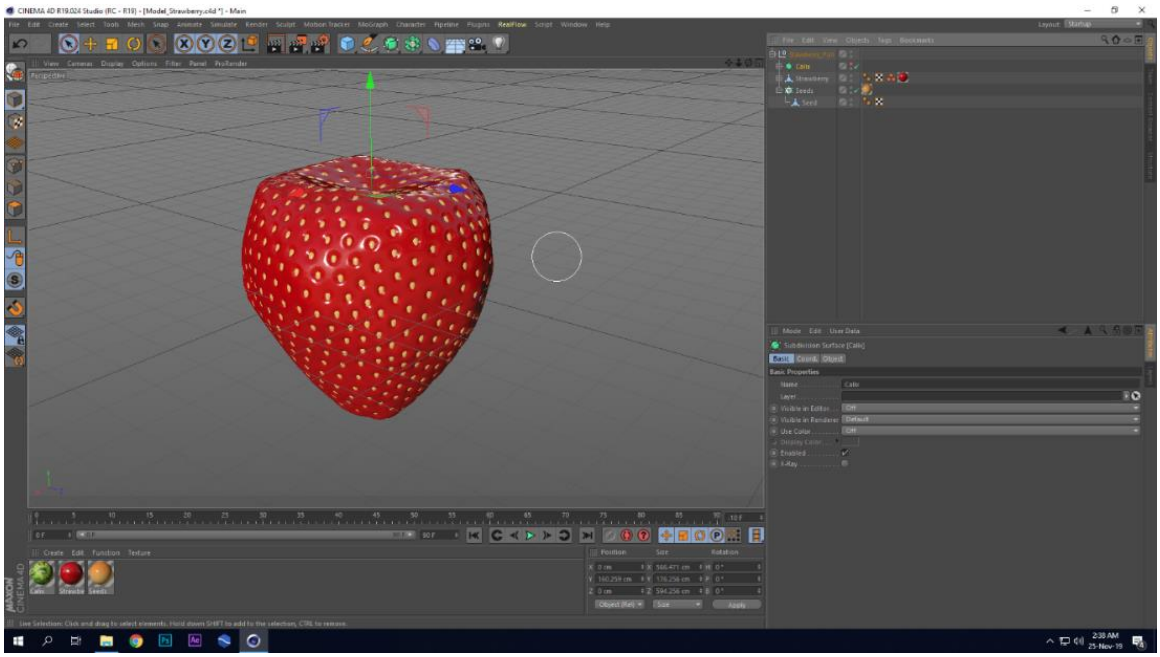

Figure 3.19: Material applied on Seeds

3.2 Chocolate

Chocolate is another important model of this project. Chocolate presents another flavor of two. Here, a piece of chocolate was made to mimic the broken part of a chocolate. The modeling process for chocolate is simpler than strawberry. Both strawberry and chocolate model had been created as representation of flavor which was shown in main denser milk spiral flow.

Modeling

Step 1: Top Viewport > Option > Config > Back > Image > browsed and imported image. Positioning and scaling were done to the reference image to form an actual size of the chocolate bar according it.

Step 2: Appropriate shape was created transforming the point's position of cube object. From the top view selecting the specific points of cube object scale command was done to position them according the reference image. Selective positioning also happened to fine tune the vertices according the reference. Four corner points were positioned down along the Y axis to get the rounded shape on each corner.

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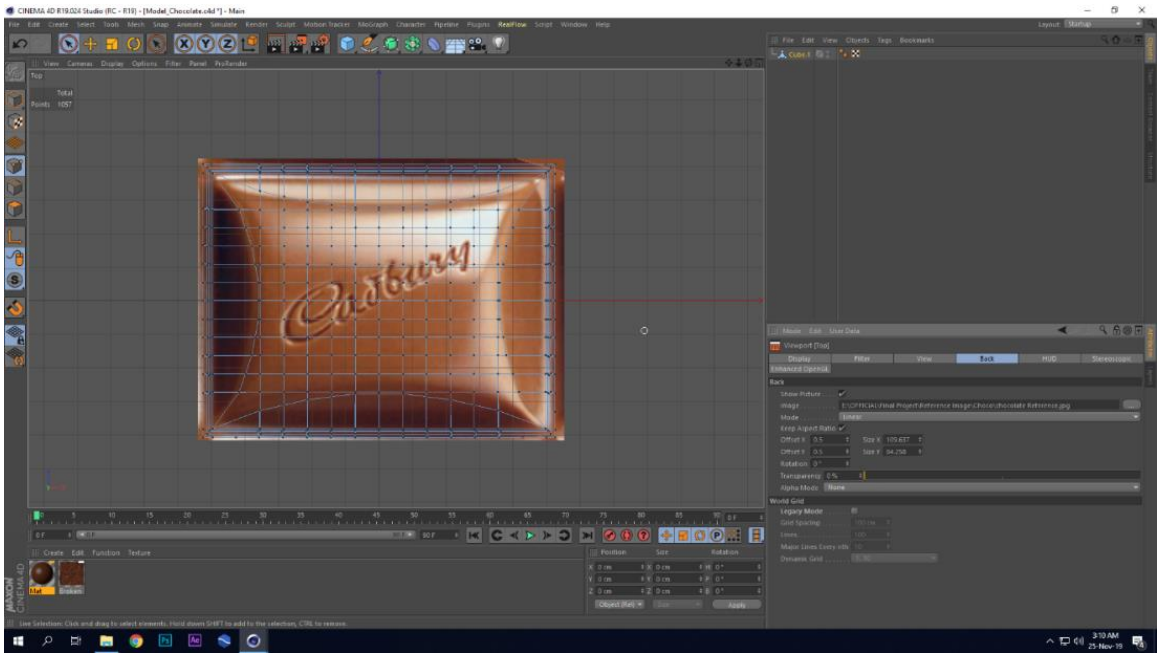

Figure 3.20: Transforming Vertices to Form Chocolate

Created low poly model with the cube object taken from the create menu.

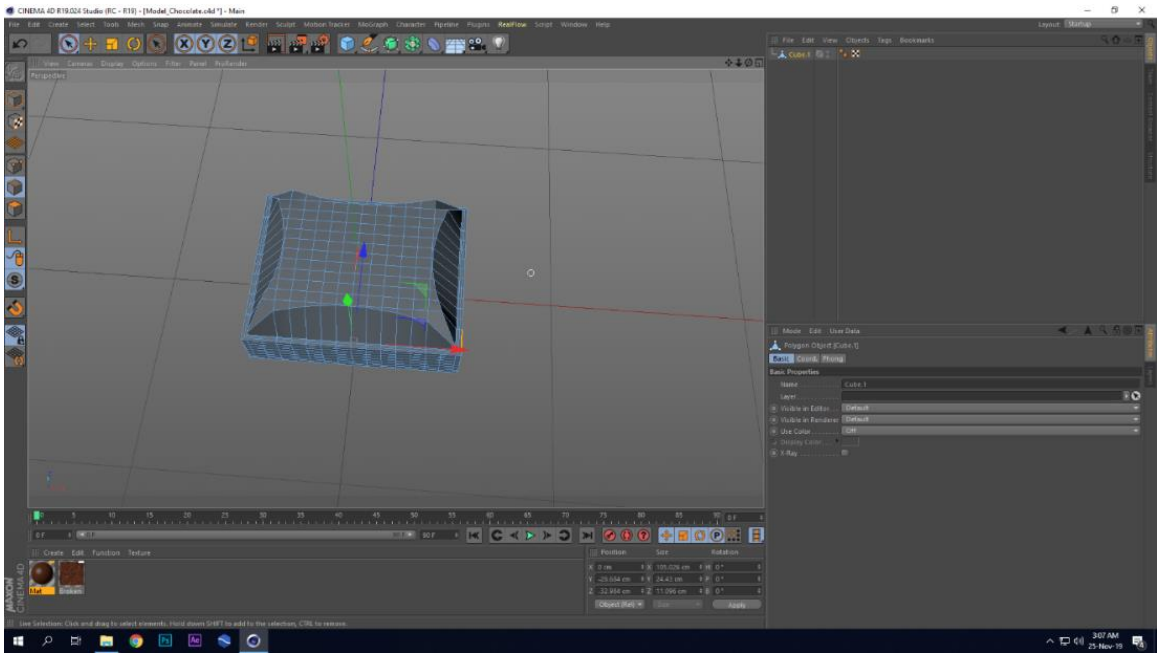

Figure 3.21: Chocolate model

Step 3: Subdivision function applied to the cube object to smoothen the model of chocolate. Subdivision type was set to catmull-clark (N-Gons), subdivision editor to 2 and subdivision renderer to 3 to have detailed model in rendered image and less detailed model in the viewport

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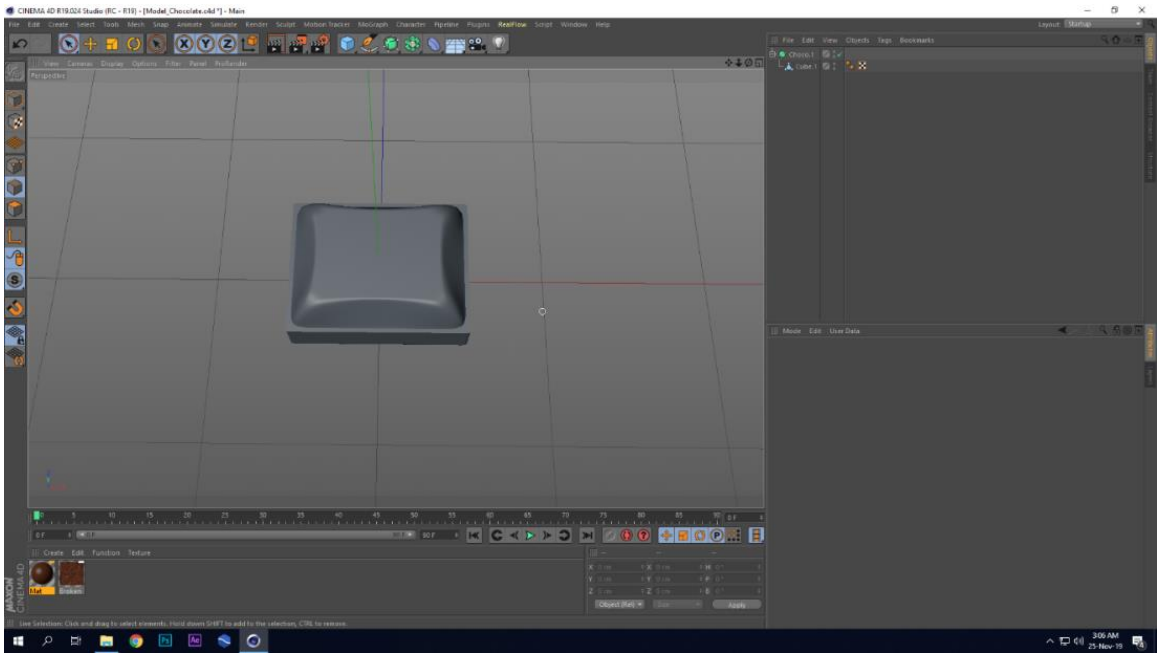

Figure 3.22: High Poly chocolate model

Material

Step 1: Color was chosen by color picker from reference image in the color channel. It's a flat color which was further developed by adding reflection and bump map on it to get the actual look.

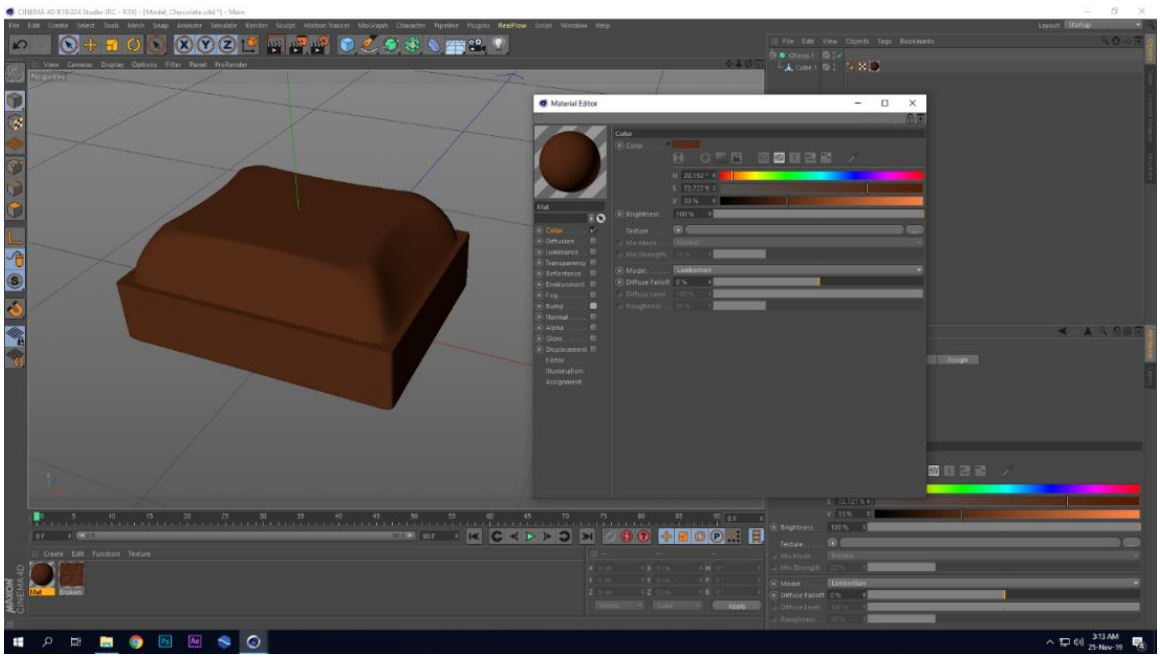

Figure 3.23: Color Channel on Chocolate Model

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Step 2: A Fresnel shader was applied as texture to the luminance channel.

Step 3: Specular- Blinn (Legacy) preset type added to the reflectance channel.

Step 4: Noise shader applied to the bump channel to create an irregular surface.

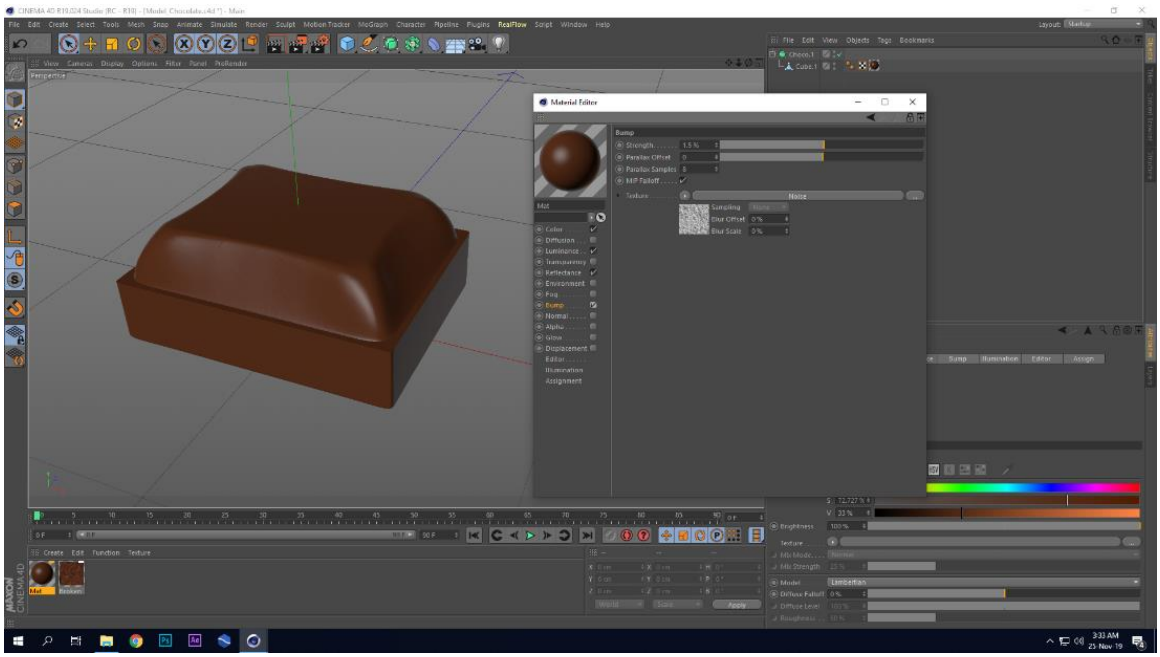

Figure 3.24: Other Channels on Chocolate Model

Step 5: Another material was applied to the bottom part to mimic the broken look.

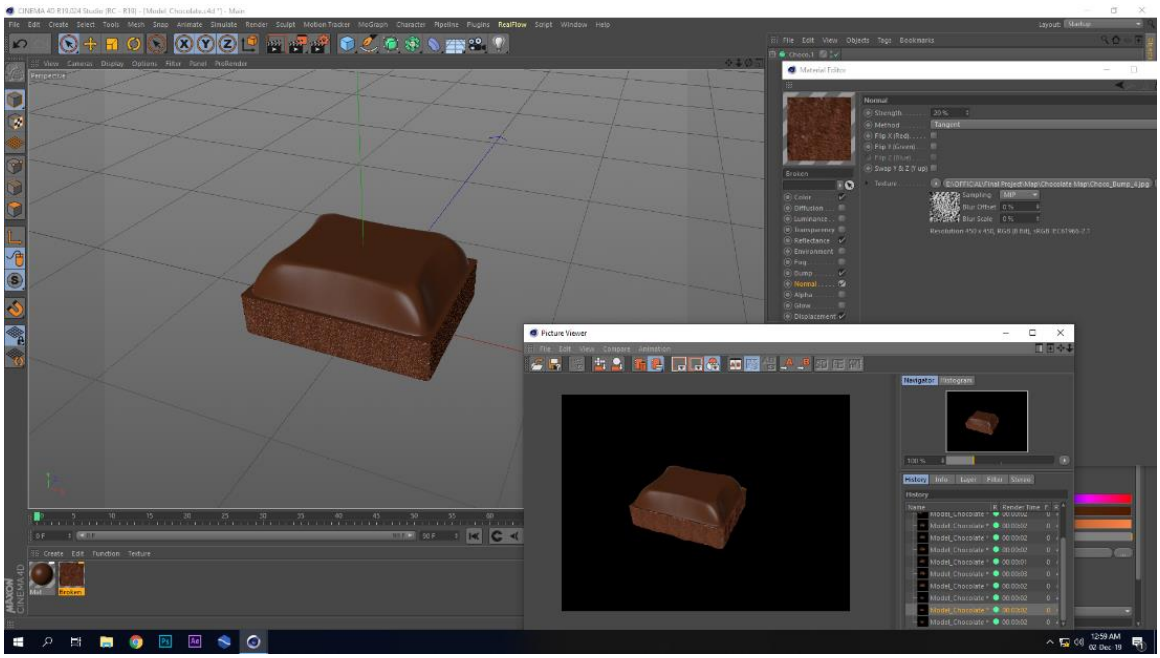

Figure 3.25: Bump Channel on Chocolate model

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3.3 Peanut

Peanut is the smallest model and its fractures were used to create nuts flow on cream.

Modeling

Step 1: Viewport > Option > Config > Back > Image > browsed and imported image.

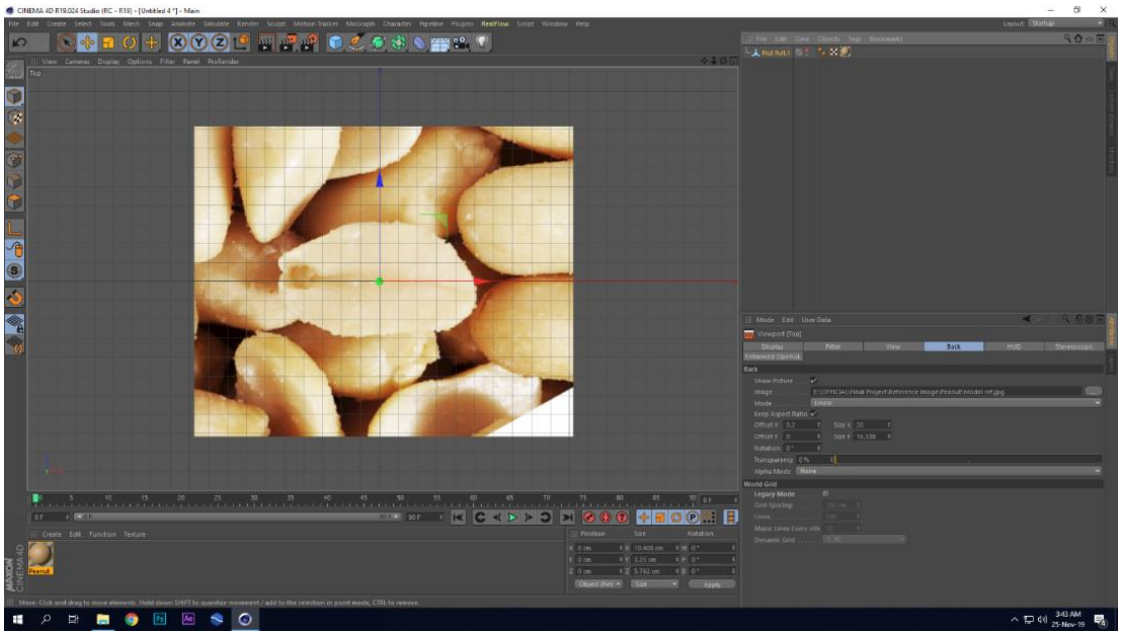

Figure 3.26: Reference Image for peanut

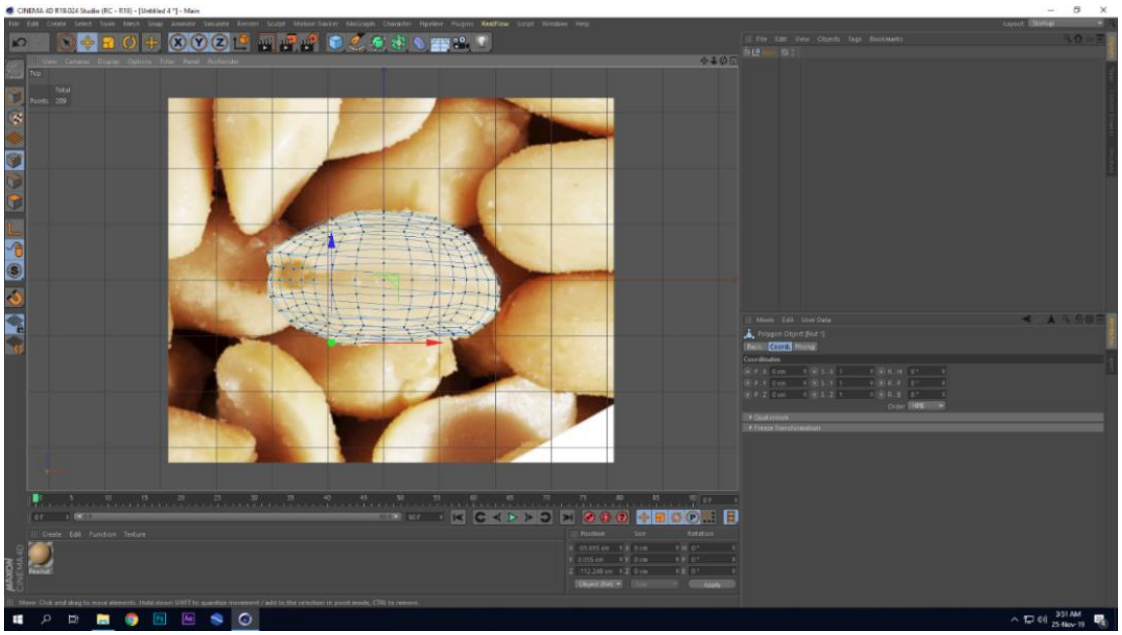

Figure 3.27: peanut modeling

© Daffodil International University

Step 2: Half of a hexahedron deleted and Point's position was changed to form peanut.

Step 3: Particular point position was transformed to create the curve line and notch on the peanut surface according the reference image.

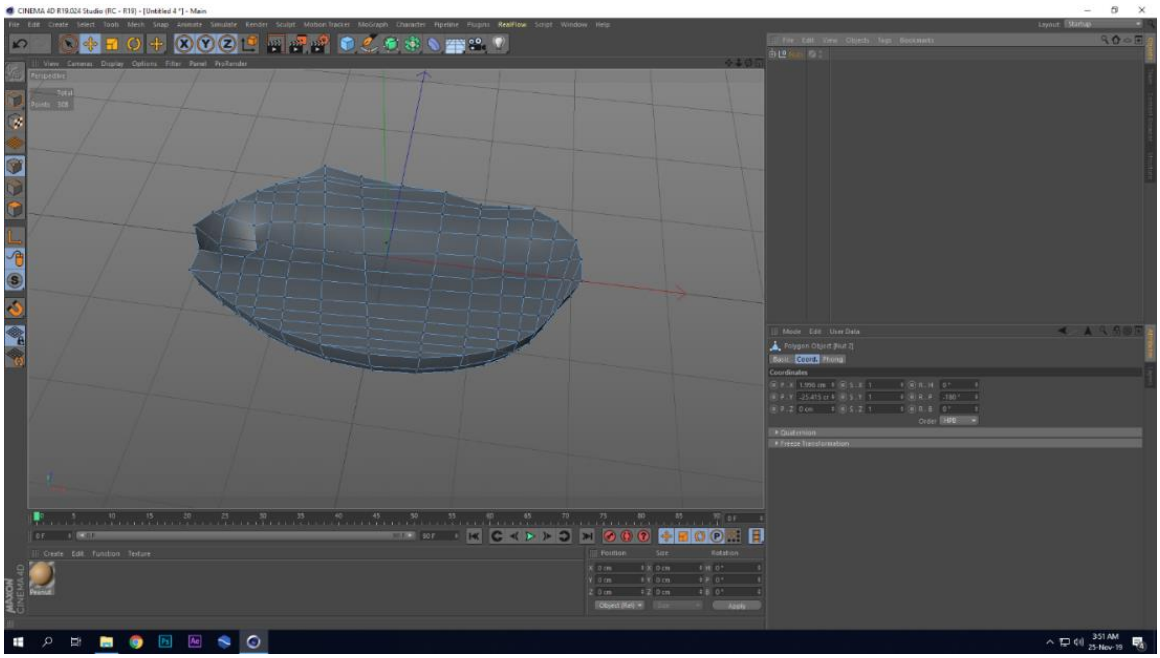

Figure 3.28: Point displacement of peanut model

Step 4: Subdivision applied to smooth the surface and eliminate the edge jaggedness.

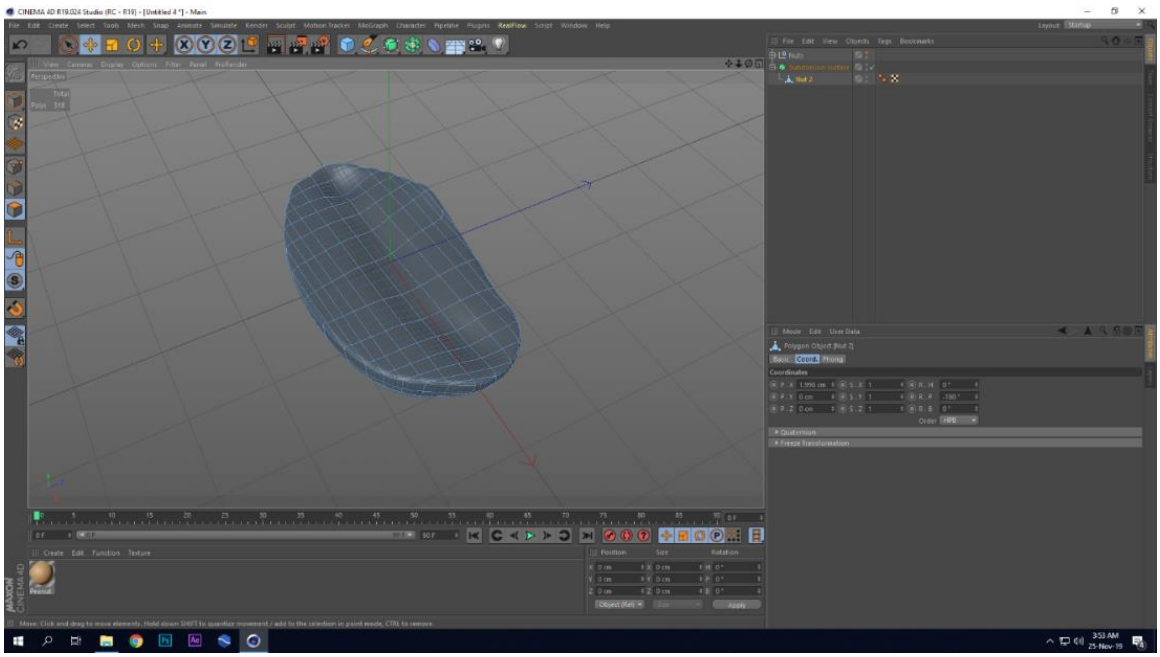

Figure 3.29: Subdivision Applied to Peanut

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Step 5: Voronoi fracture had been applied to get some chunks of the peanut.

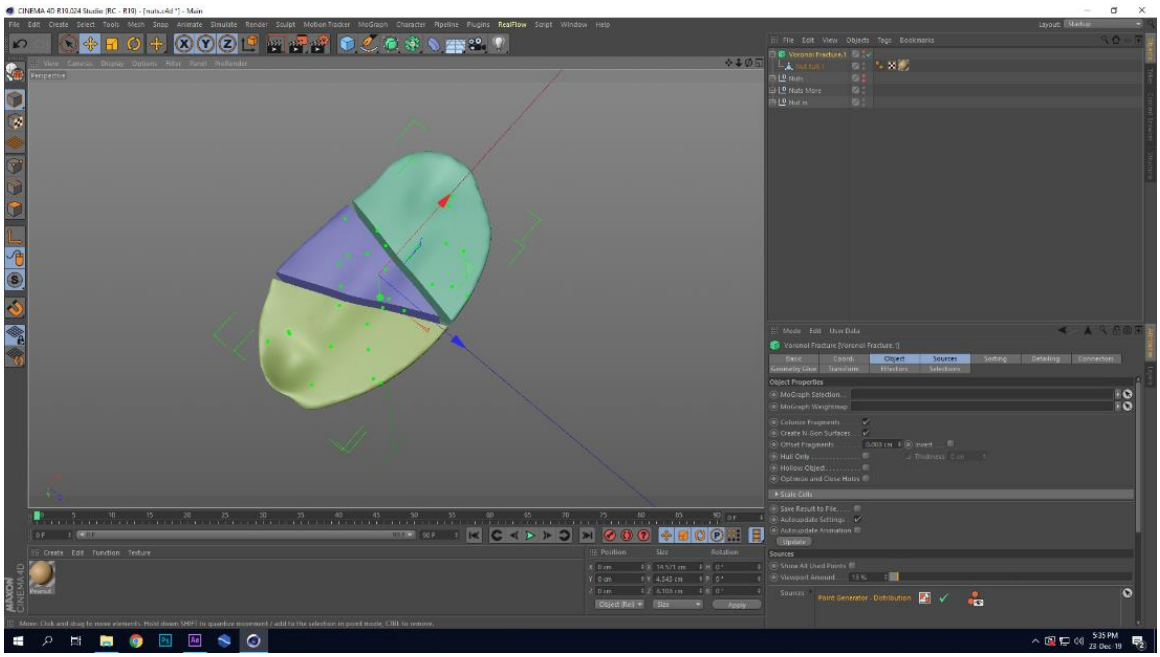

Figure 3.30: Peanut fractures by Voronoi Fracture

Material

Step 1: A brownish color chosen from the reference image in color channel of material editor. Diffuse model was set to Oren-Nayar to have less reflective surface on peanut.

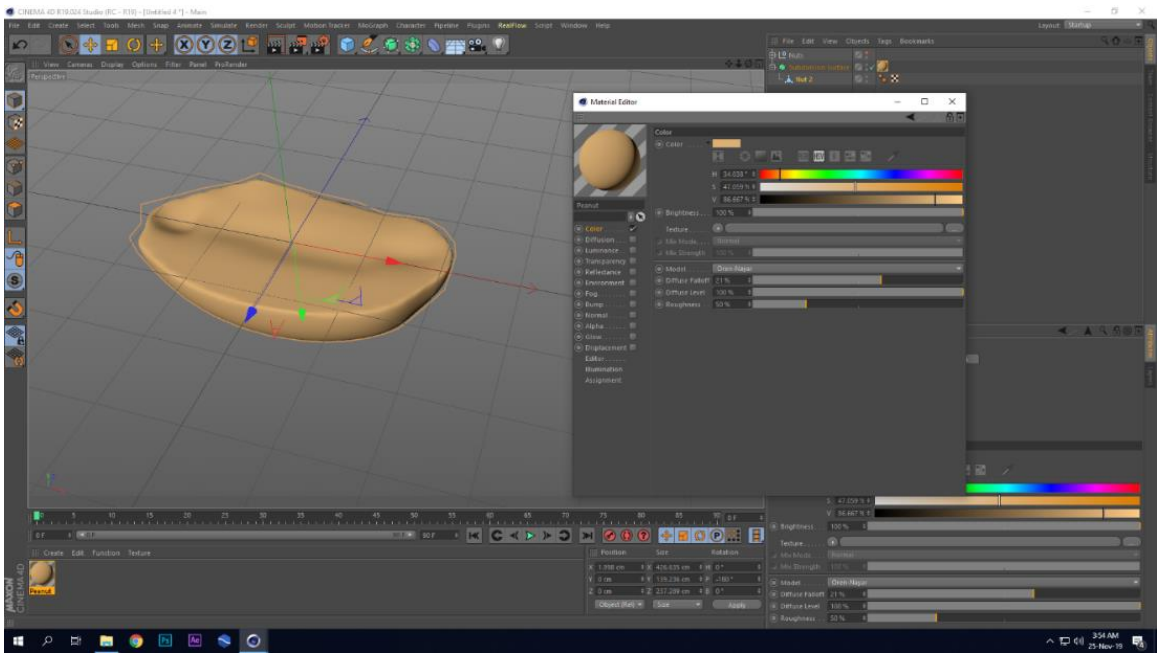

Figure 3.31: Color Channel on Peanut Model

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Step 2: “GGX” preset was chosen over the default specular layer having Specular-Blinn (Legacy). Width set to 60 %, specular strength to 20 % and master brightness to only 15% to have a minimal specular highlight with diffused reflection.

Step 3: Noise shader was applied to bump channel to create micro bump on the peanuts surface. Bump strength was set to only 0.7%, parallax offset to 0 and parallax samples to 8 to achieve desired look.

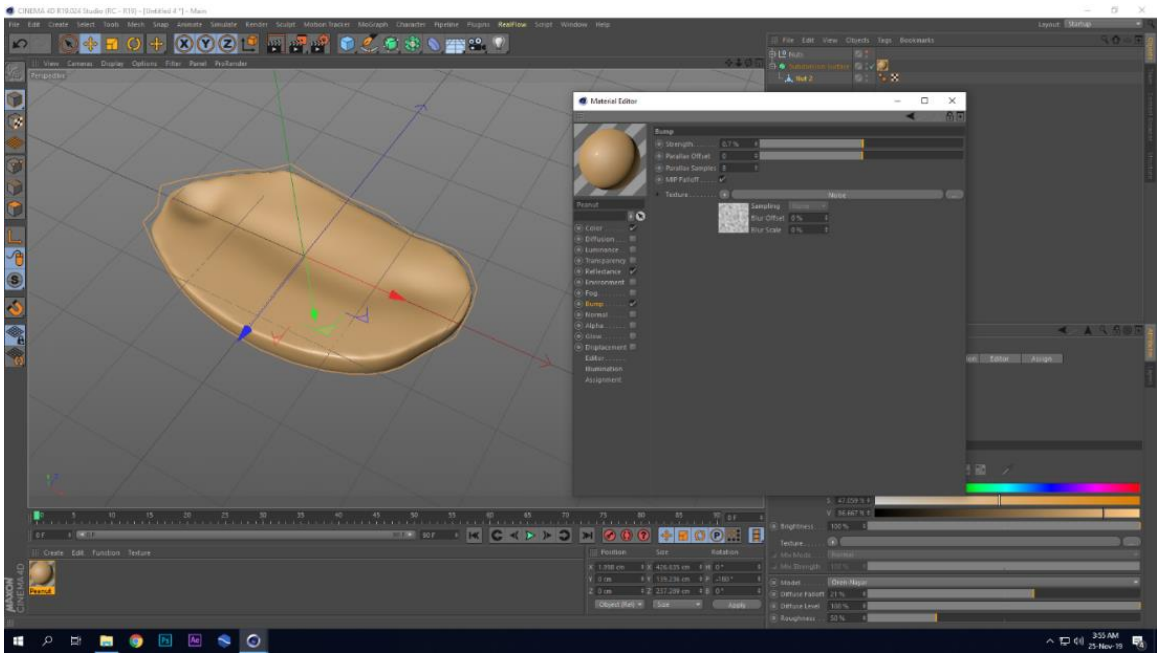

Figure 3.32: Other Channels on Peanut Model

3.4 Cone

In this ice-cream visualization cream holder brownish cone is the most important model. Cone is the largest visual part of the ice cream model. Cone model was created not by as usual modeling process rather than by applying displacement map.

Modeling

Step 1: A simple cone object was taken from the create menu to form the cone model. Upper open part was extruded to create the border fold from where the cream part started. Then subdivision function had been applied to the model to have the effect of displacement map which is the main modeling process for the cone model.

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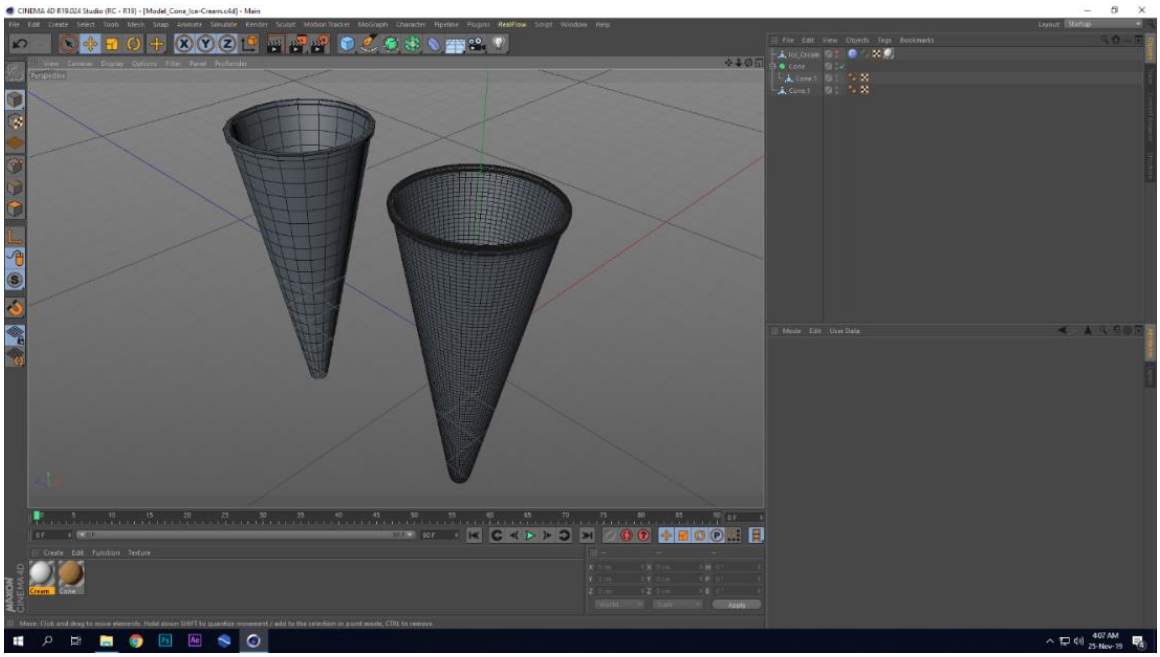

Figure 3.33: Low and High Poly Cone Model

Material

Step 1: Displacement map applied to form the crossways pattern on the cone body. Displacement map was created by the Mograph cloner using box.

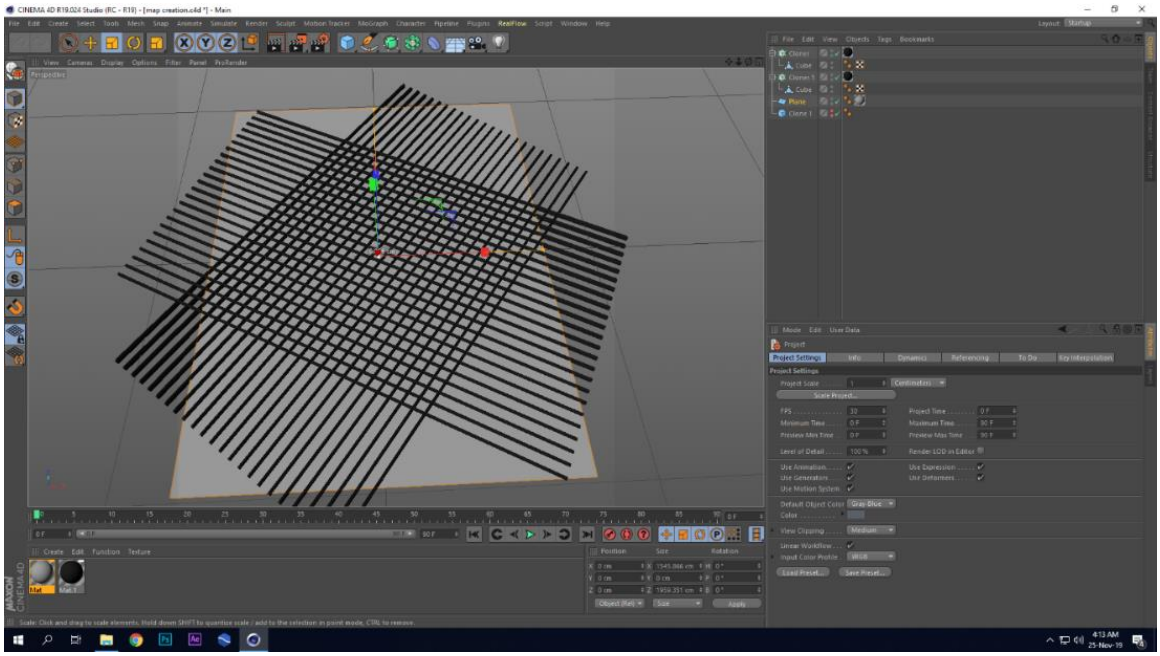

Figure 3.34: Creation of Displacement Map

Step 2: A black and white image is created for the displacement map these boxes.

© Daffodil International University

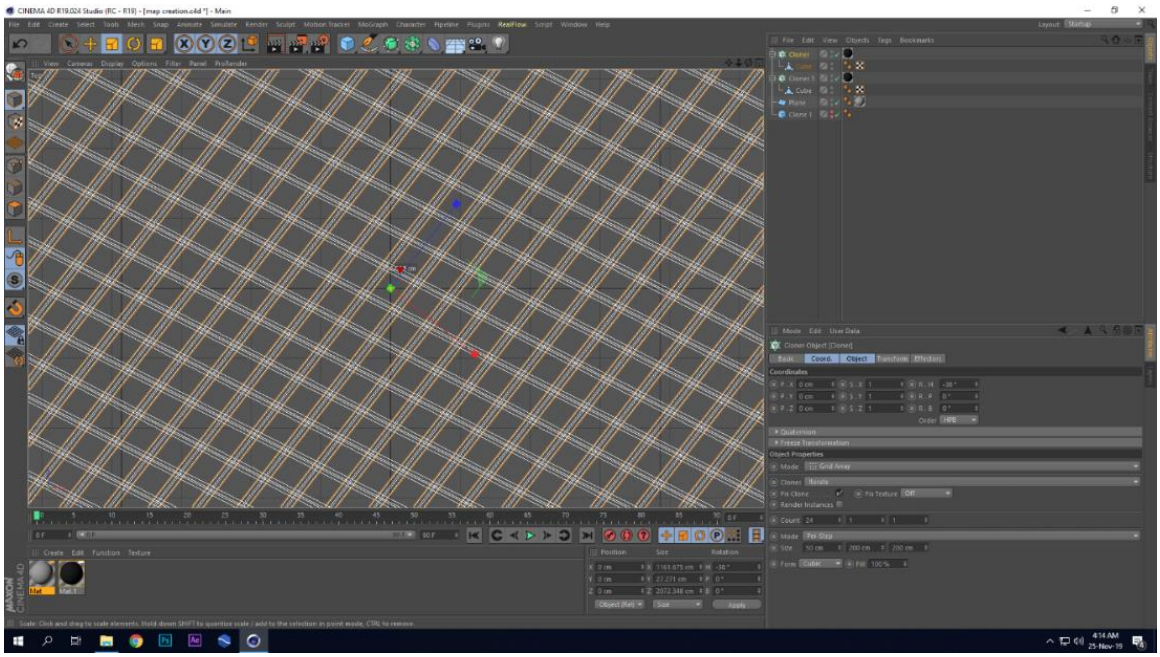

Figure 3.35: Creation of Displacement Map (Render View)

Step 3: Gradient was added to keep a light influence on the bottom of the cone in PS.

Step 4: Same grayscale image was applied to the diffuse channel with some variation.

Step 5: Noise shader added to the bump channel to create irregular surface. Poxo was selected as noise type to create the actual micro bumpy surface.

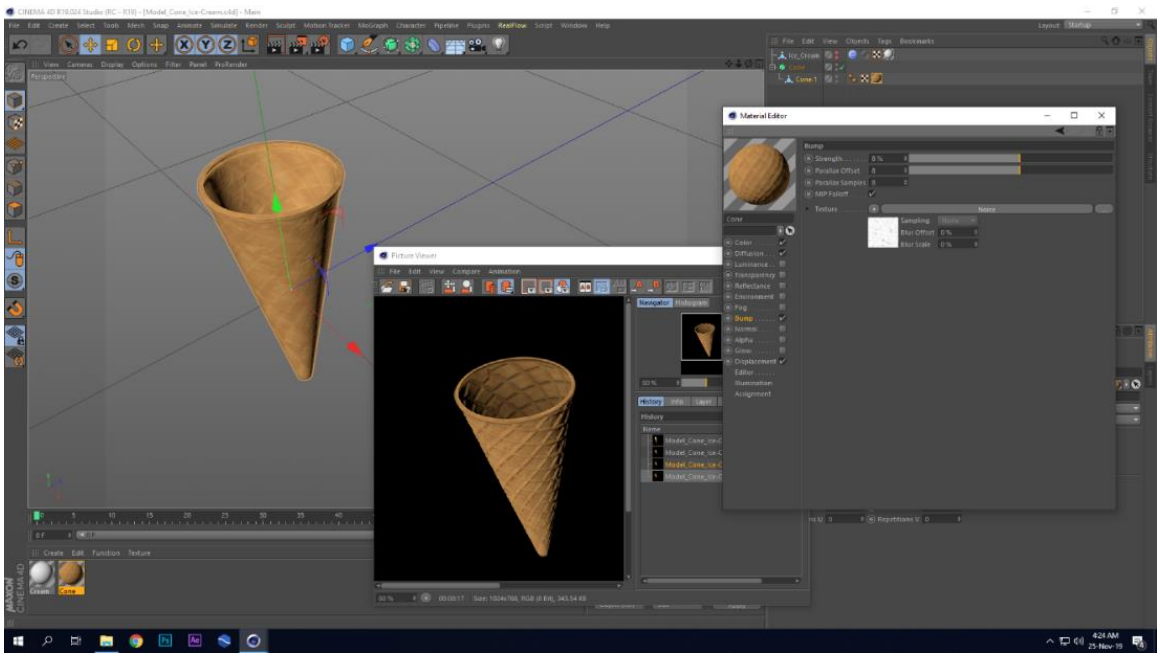

Figure 3.36: Bump Channel on Cone Model

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Step 6: An inverted image was used as texture to the transparency channel which had been previously used as displacement map.

3.5 Ice-Cream

Through the whole visualization the ice-cream was showed and the most attractive part of the model is the two-colored cream. It represents the flavors with its colors. Pink color represents the strawberry and chocolate color represents the chocolate flavor.

Modeling

Step 1: Ice–cream modeling was happened by sculpting over a simple cone. This cone was taken from create menu. A connect function was ran over the cone to connect the cap with its cylindrical shape. Otherwise the cone didn't allow me to sculpt over it.

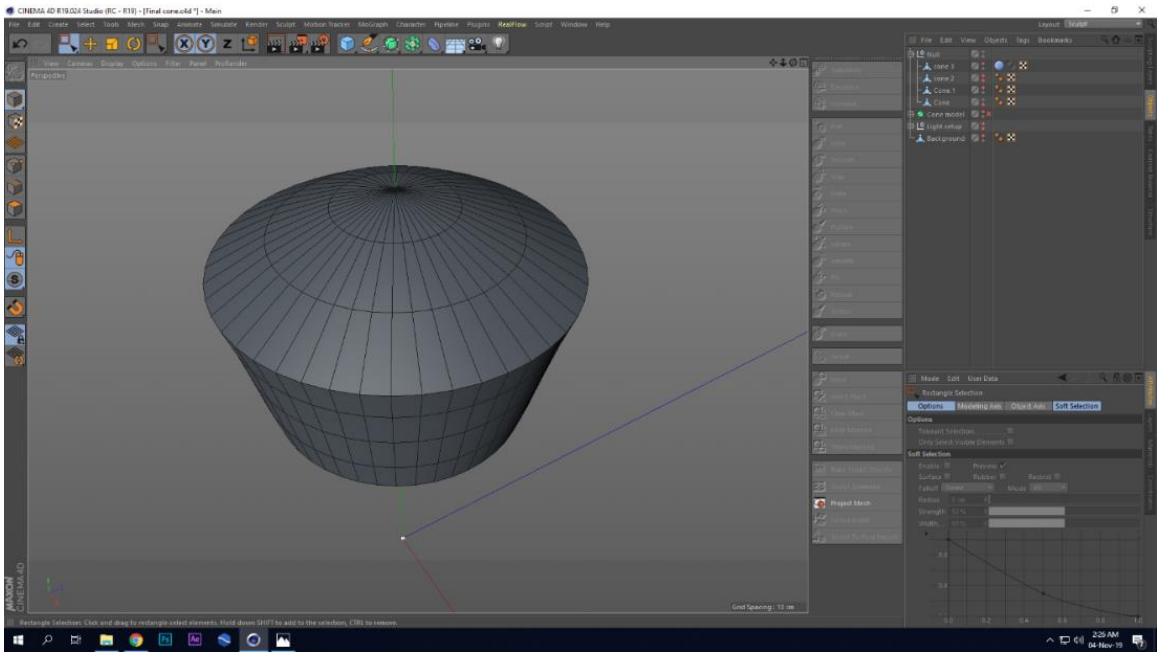

Figure 3.37: Modified Cone for Ice-Cream Modeling

Step 2: Subdivision function was also been applied to create this cone smoother and also to make able to sculpt over it.

Step 3: Sculpting part started by switching from startup to sculpt layout mode. By pressing the increase button cinema 4d allowed me to sculpt over the cone object.

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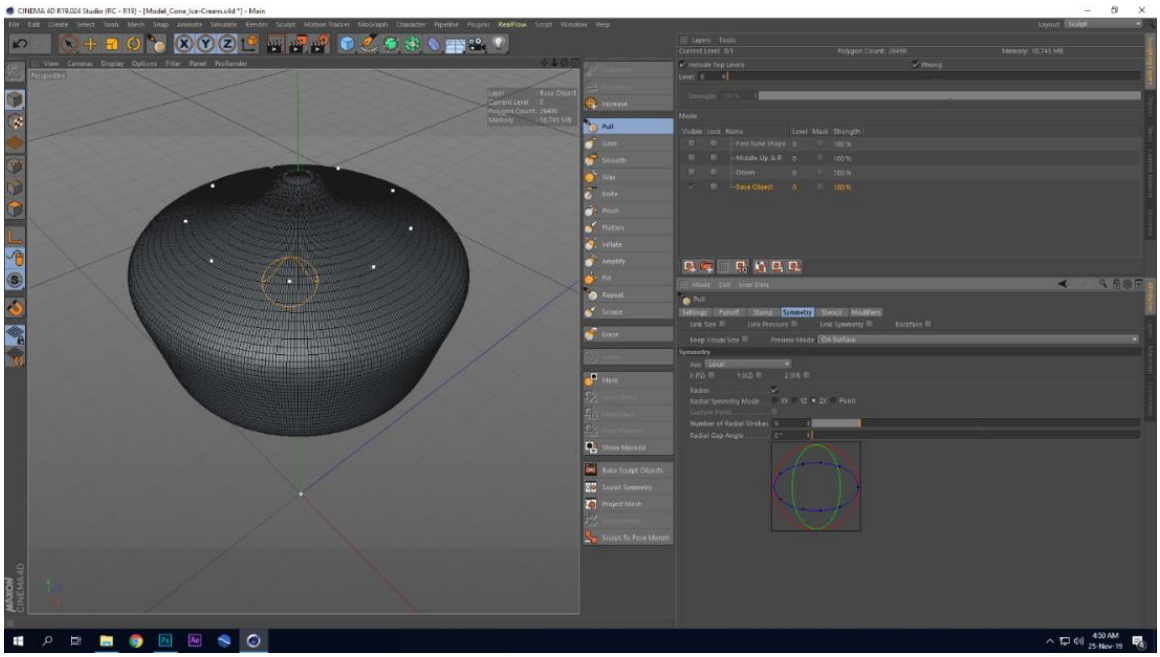

Figure 3.38: Activating sculpting Layout

Step 4: An inverted pull brush was taken checking the radial symmetry with step 9. And these nine symmetrical brushes helped to create the pattern simultaneously at nine places over the cream model surface.

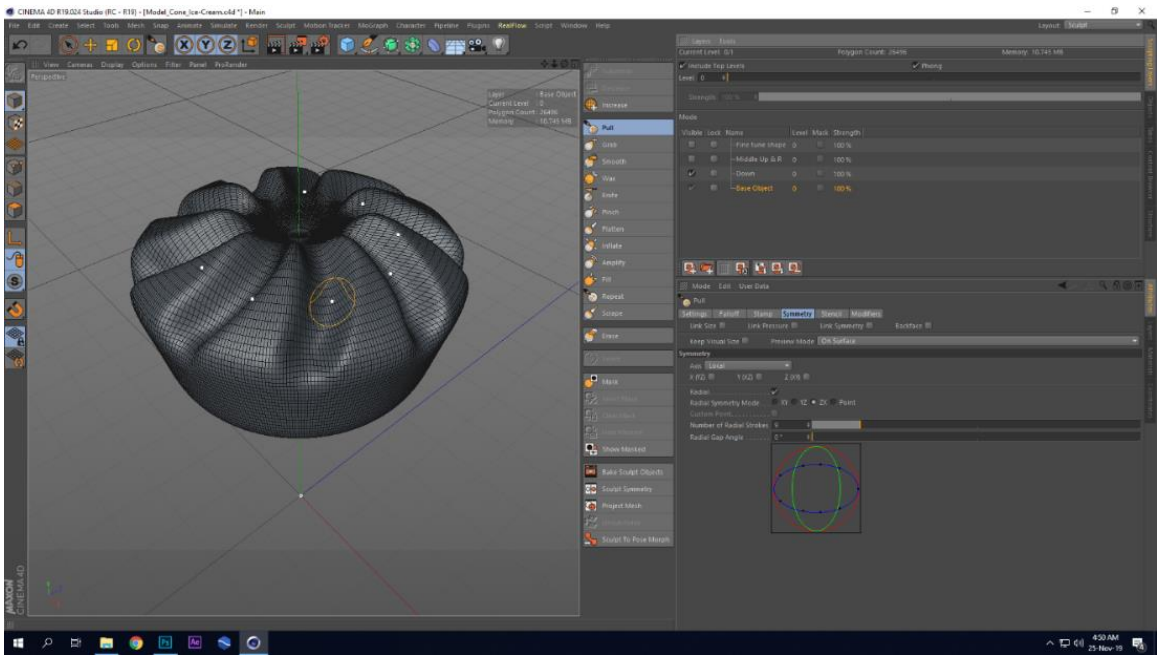

Figure 3.39: Inverted Pull Brush on Cone

Step 5: Fill brush was used to fill up the hole created during main flow buildup process. Wax brush was used to add more surface to certain position of the model.

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Step 6: Flatten brush used to flatten down some unnecessarily angular form of the geometry. Smooth brush was mostly used brush all over the sculpting process.

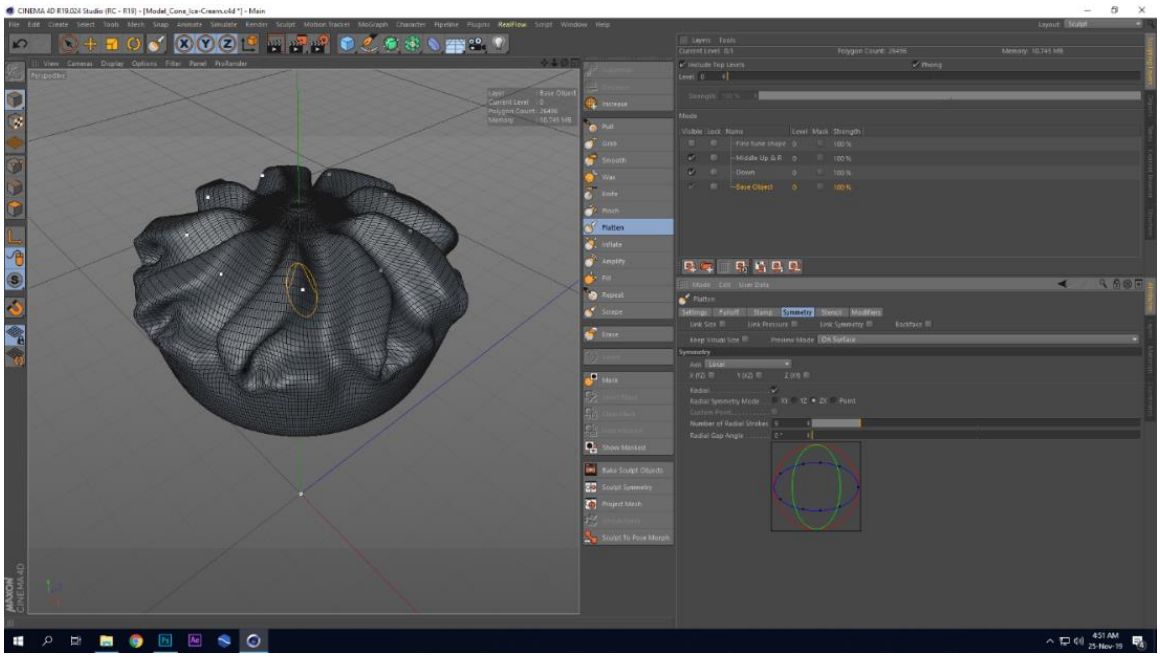

Figure 3.40: Wax, Fill, and Flatten Brush on Cone

Step 7: Smooth brush was used on the uneven and improperly placed faces to recover them. Smooth brush also removed the jagged edges of the pattern.

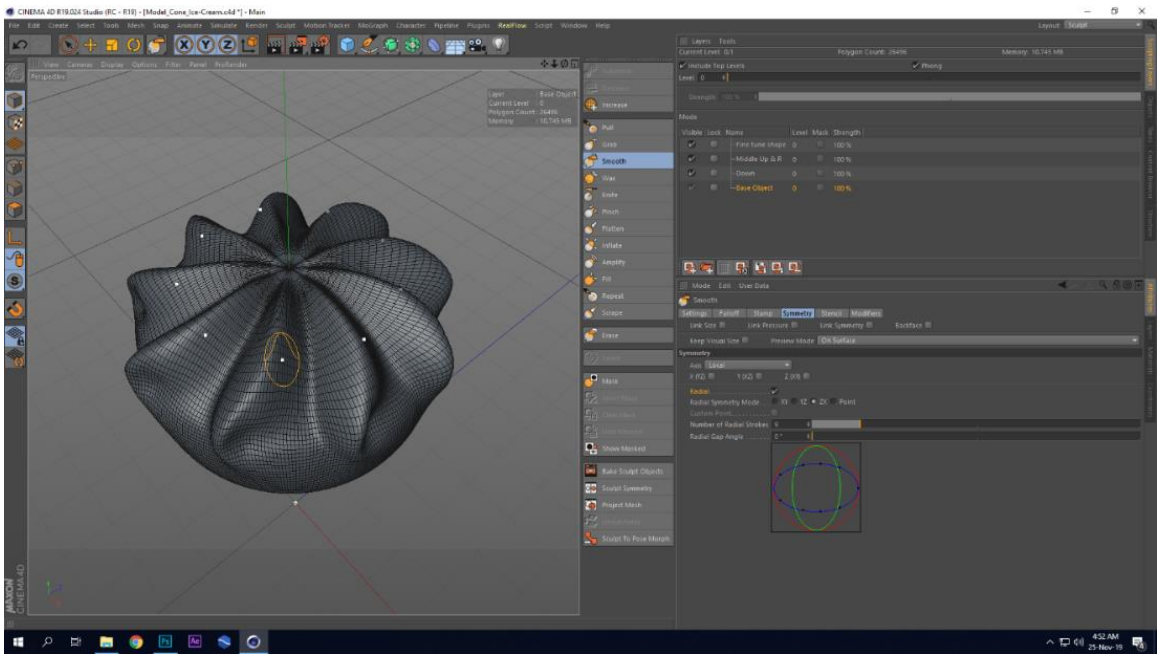

Figure 3.41: Ice-Cream Model

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Material

Step 1: White was chosen as ice-cream color from the color channel.

Step 2: In reflectance channel frenal added with milk preset from dielectric mode.

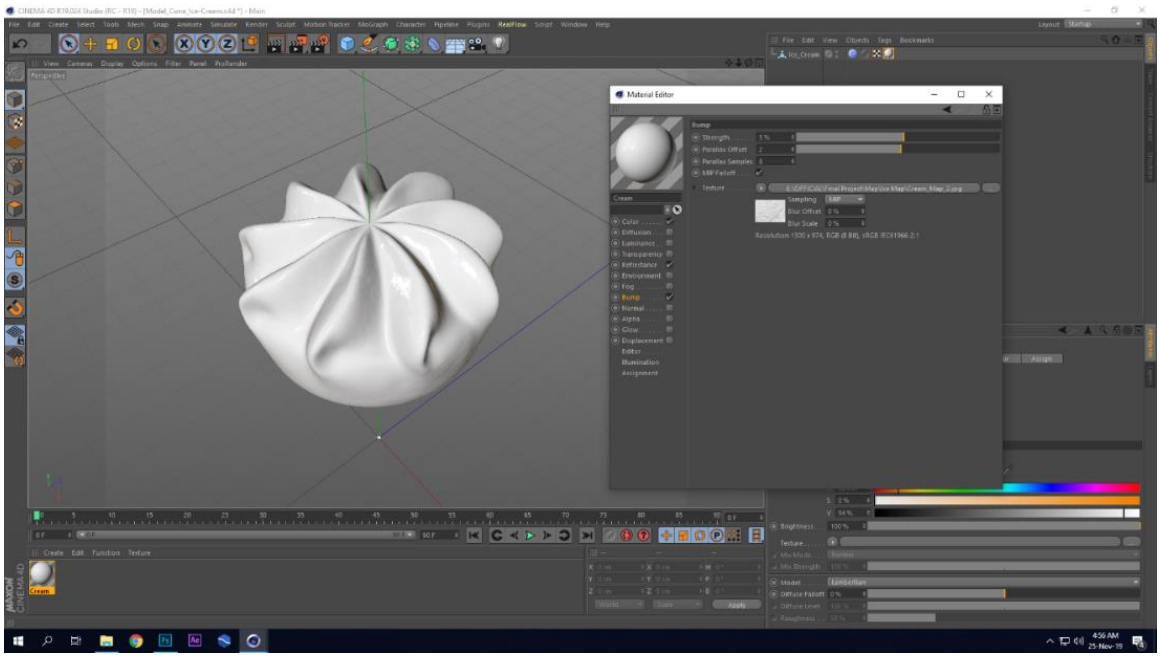

Figure 3.42: Material applied on the Ice-Cream Model

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CHAPTER 4

SIMULATION AND ANIMATION

4.1 Core simulation

Simulation part had been done with the help of Realflow | Cinema 4D 3 plugin in cinema 4D R19. Realflow 10, the main software was ignored for crating the simulation part because it is too slower and buggy than the core plugin for cinema 4D. Flow of denser milk is the expected outcome of this section of creation. A daemon called Dspline had been used to create the core spiral flow of denser milk. This part of simulation

Step 1: A helix taken from spline menu to create the path of the flow of milk. Outer radius, inner radius, height had tweaked according my choice to get the desired shape for the path which the particles was followed.

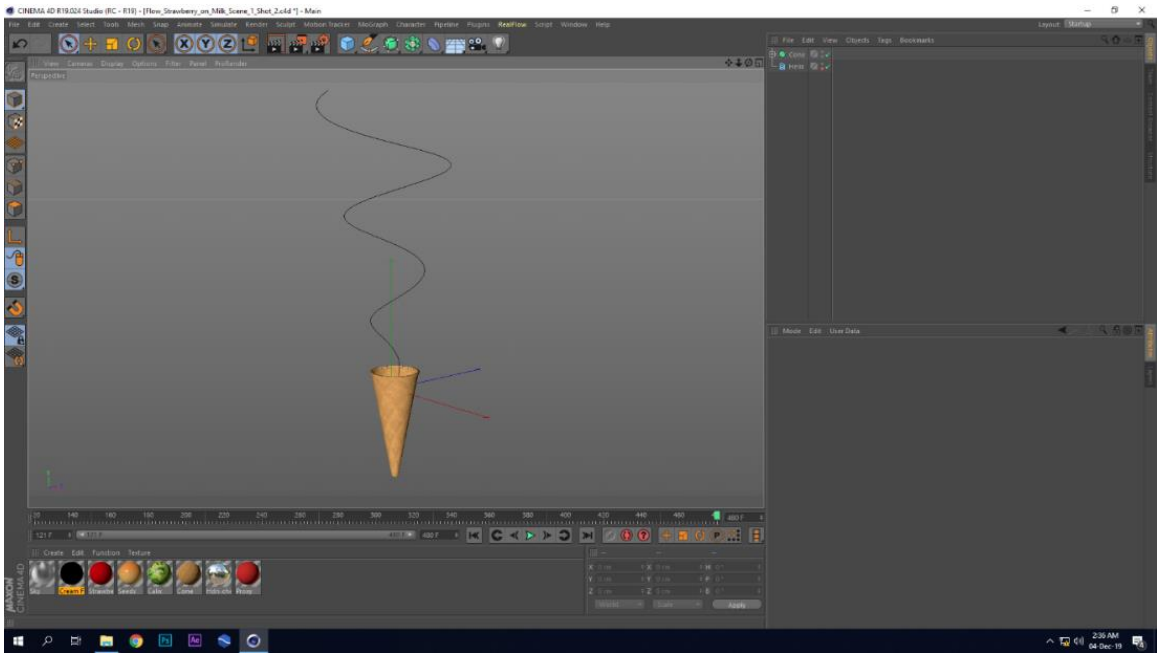

Figure 4.1: Helix Object Path of the Flow

Step 2: A circle emitter taken from the dropdown menu of Realflow plugin. A whole linked scene with mesher, daemon, fluid had been added to the object manager. Width and height of the emitter was tweaked to get a flatter flow of milk. Otherwise it creates a uniform growing shape of a tube.

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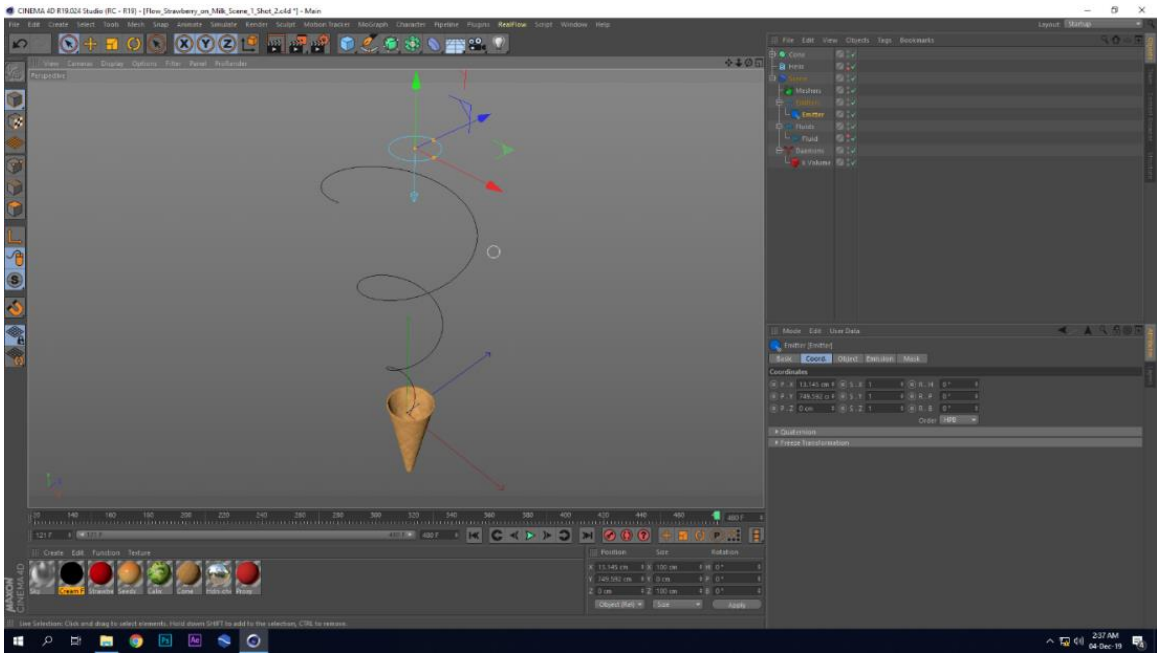

Figure 4.2: Emitter for the Flow

Step 3: Dspline daemon taken from Realflow plugin menu to restrict the flow of the emitter. This daemon also constrains particles to follow the defined path.

Step 4: Helix added to the path option of the daemon to define the path for the flow.

Step 5: Particles were cached by clicking the cache simulation button in the cache tab.

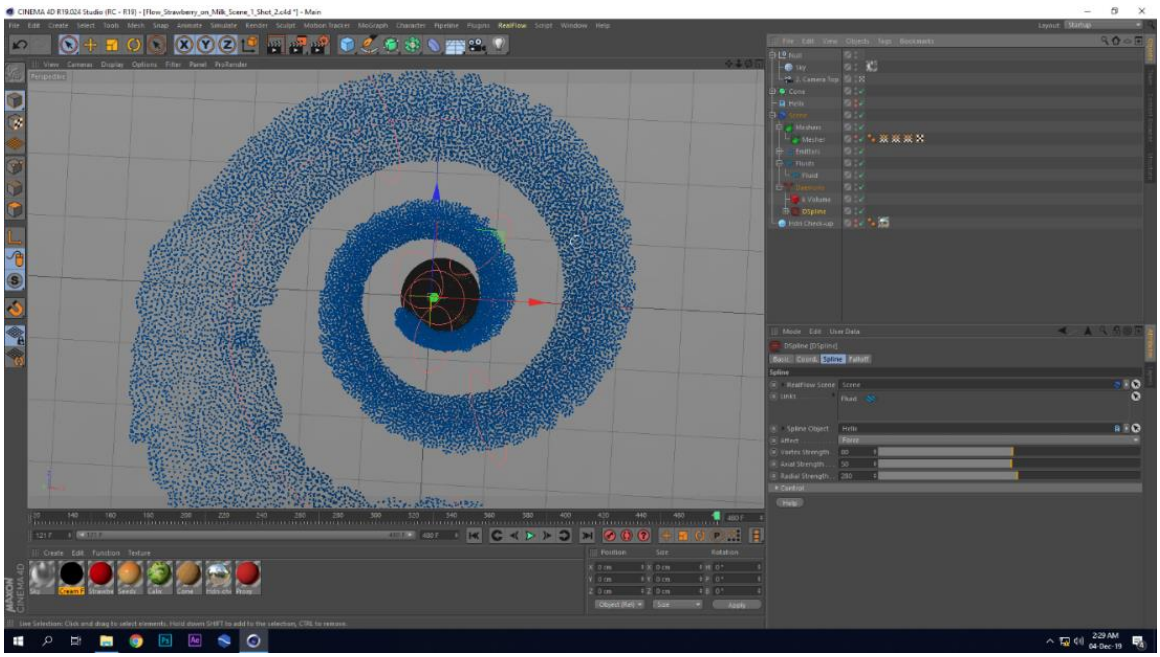

Figure 4.3: Particles of the Flow

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Step 6: After caching the particles a mesher was chosen to convert the particles to mesh. Triangles was selected as topology type for the mesh. Resolution set to low, radius 5cm, smooth value to 6 to bring out the desired look of the mesh.

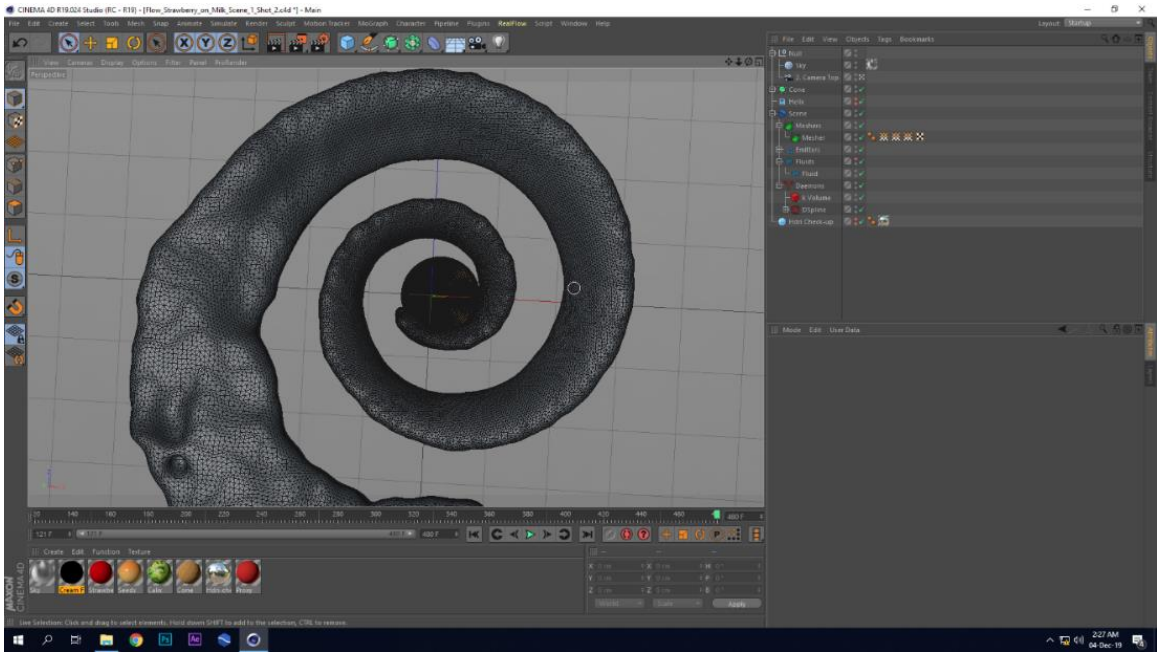

Figure 4.4: Mesh of the Flow

Another image having a smoother gouraud shading had been added to visualize the form of the mesh properly.

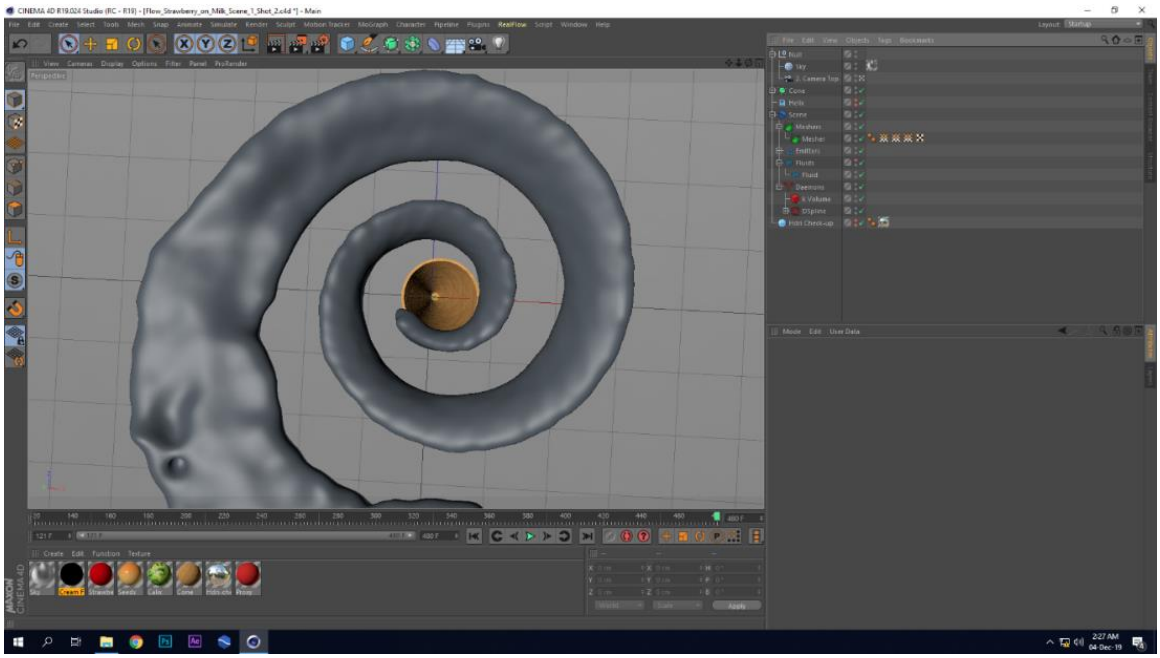

Figure 4.5: Mesh of the Flow (Gouraud Shading)

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Material

Step 1: White was chosen as color from HSV in color channel.

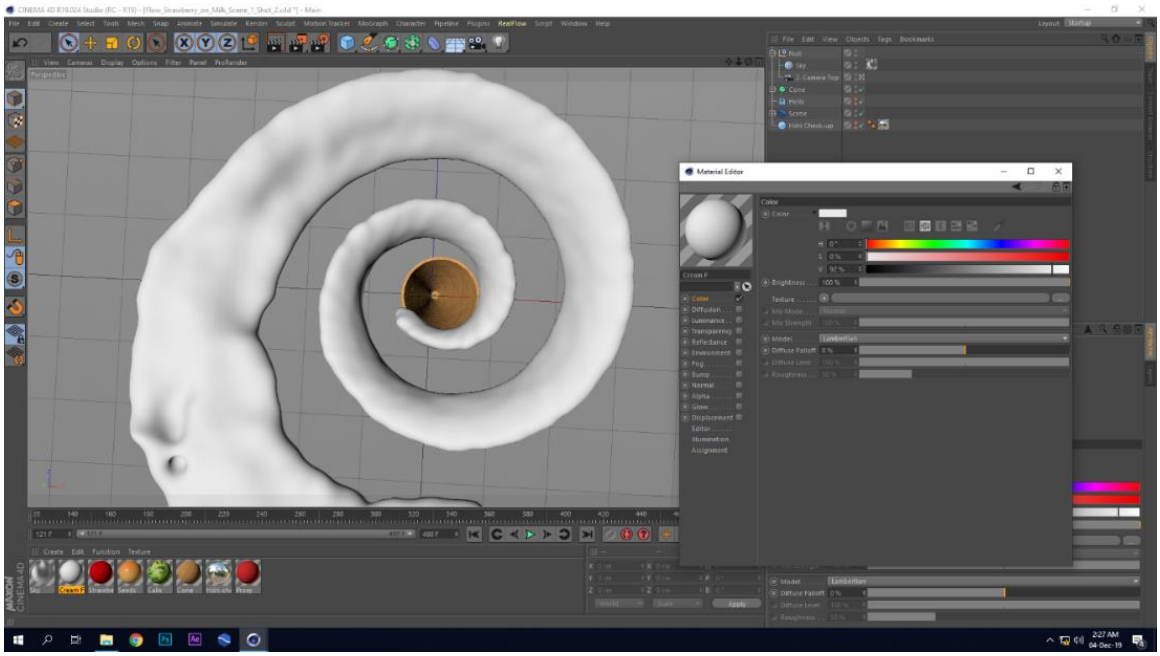

Figure 4.6: Color Channel on Flow

Step 2: Beckmann preset was chosen from the type's dropdown menu in the reflectance channel. Master reflection was controlled from the layer brightness slider.

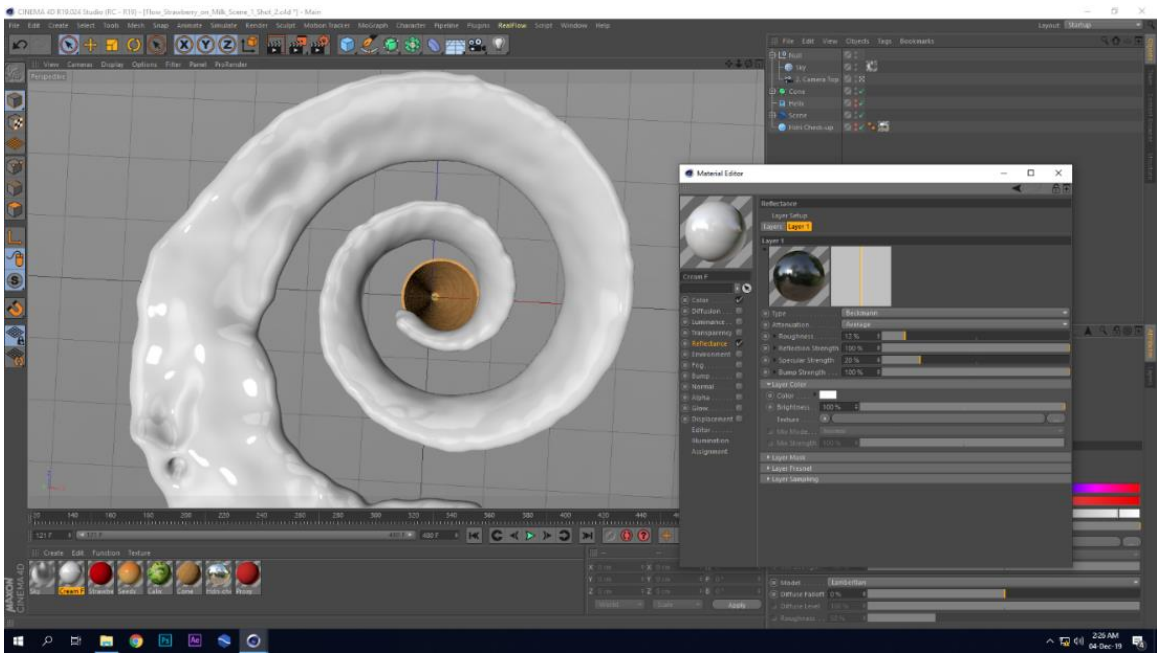

Figure 4.7: Reflectance Channel on Flow

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4.1.1 Strawberry Animation

Step 1: Strawberry was cloned on helix path by linking the helix with object option. Step and Offset start were animated to maintain the distance between each model.

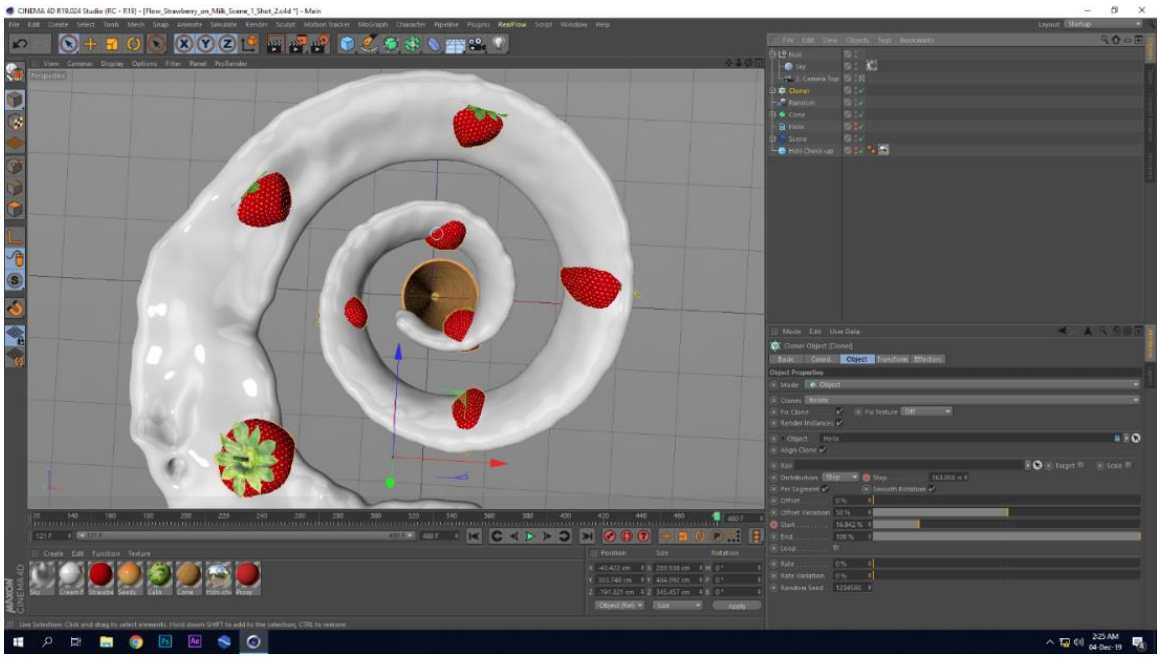

Figure 4.8: Strawberry over the Flow

4.1.2 Chocolate Animation

Figure 4.9: Chocolate over the Flow

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Same steps were followed to animate the chocolate as in the strawberry animation.

4.2 Syrup Simulation

In this creation part, syrup flow of two flavor strawberry and chocolate was created.

4.2.1 Strawberry syrup

Step 1: Full Ice-cream model was imported to a new scene.

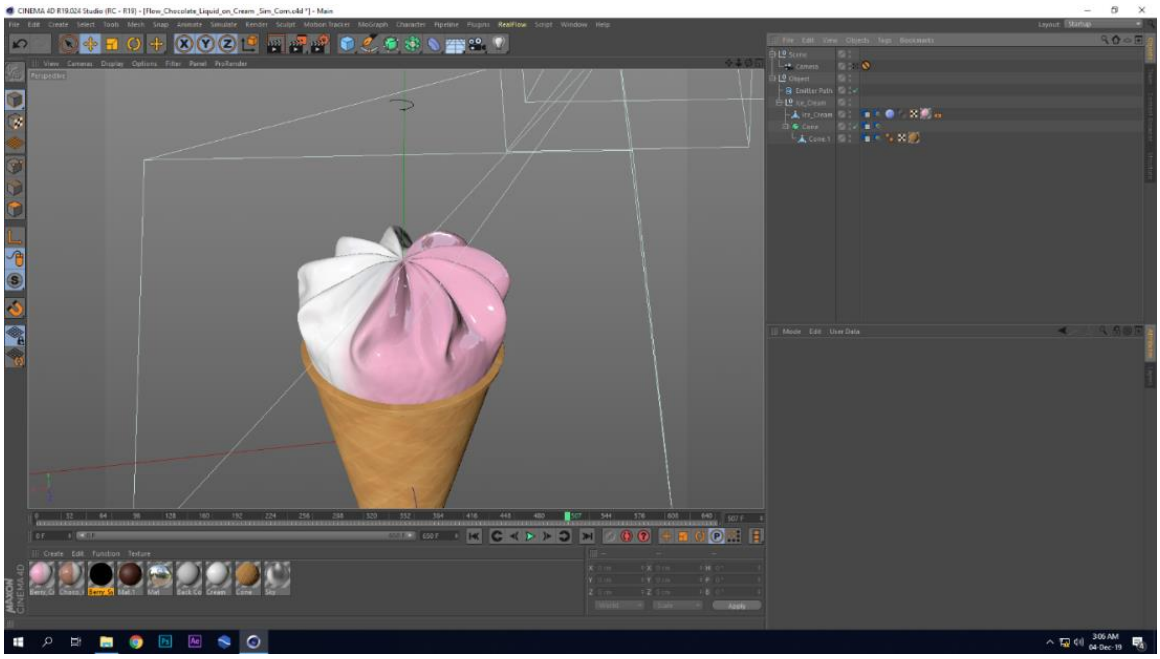

Figure 4.10: Imported Ice-Cream Model

Step 2: Collider tag and volume tag was added to the ice-Cream Model to make sure collision between syrup particle and ice-Cream model. Cell size from volume tag was tweaked to have appropriate collision.

Step 3: A circle emitter was taken to create the strawberry syrup simulation. That emitter was scaled down to width and depth 6.5 to get narrow sticky flow of strawberry syrup. Vertical random was tweaked to maintain the continuous flow.

Step 4: Speed and position of the emitter was animated along the notches of ice-cream. And for final fall on the center of the ice-cream emitter went along the helix path. Align to spline tag was added to the emitter to bound the emitter to follow the helix path.

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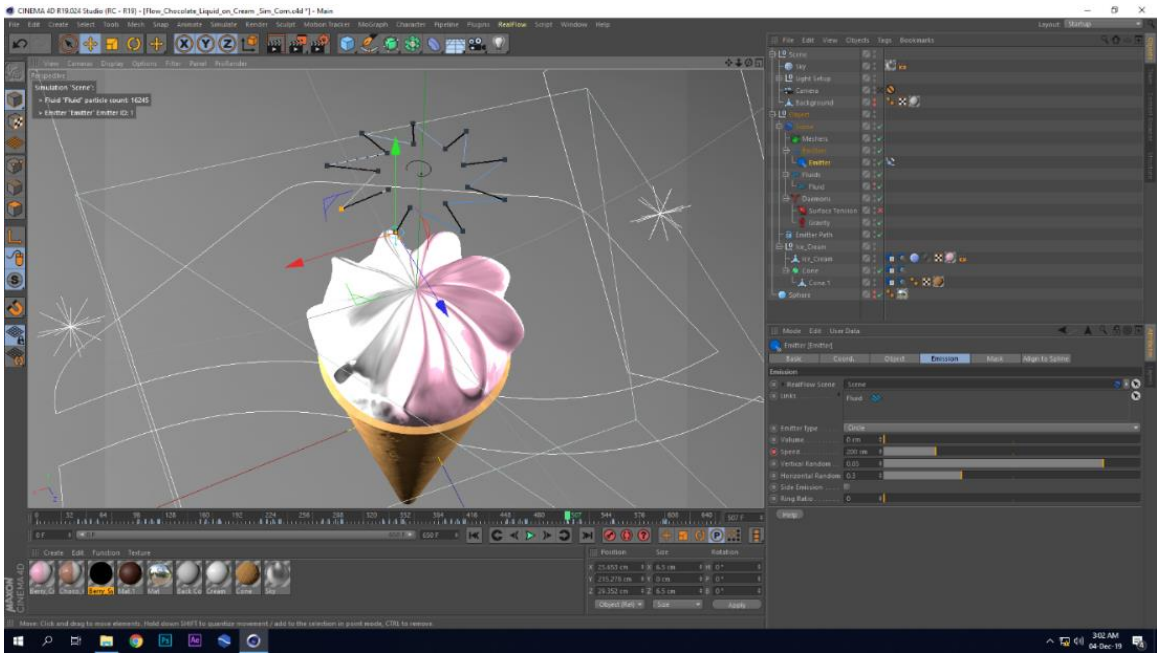

Figure 4.11: Emitter Animation Path

Step 5: Options of fluid tab of fluid object altered according the desire look. Viscous was chosen as fluid type preset to get stickier and more viscous look. External pressure scale and viscosity was animated during helix path travel to get denser and stickier look. Minimal value added to the Cohesion and Damping parameter to achieve the stabilized look of the particles.

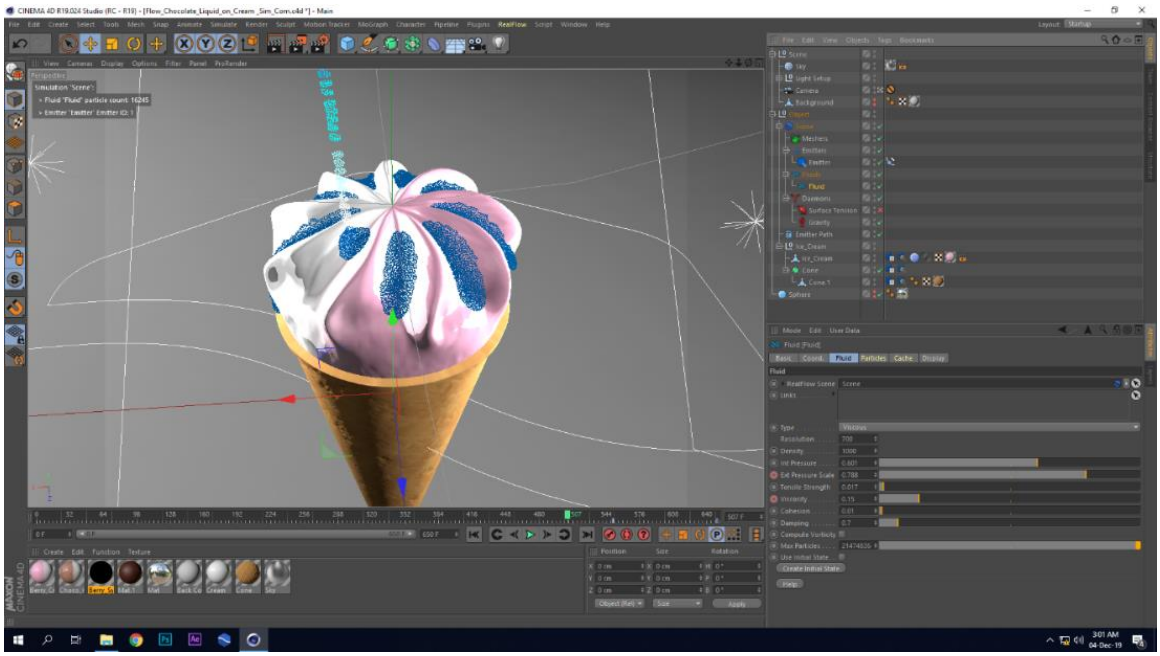

Figure 4.12: Particles of Syrup Flow

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Step 6: When I got the look, I wanted then clicked on the cache simulation button from cache tab of the scene object selecting cache file path.

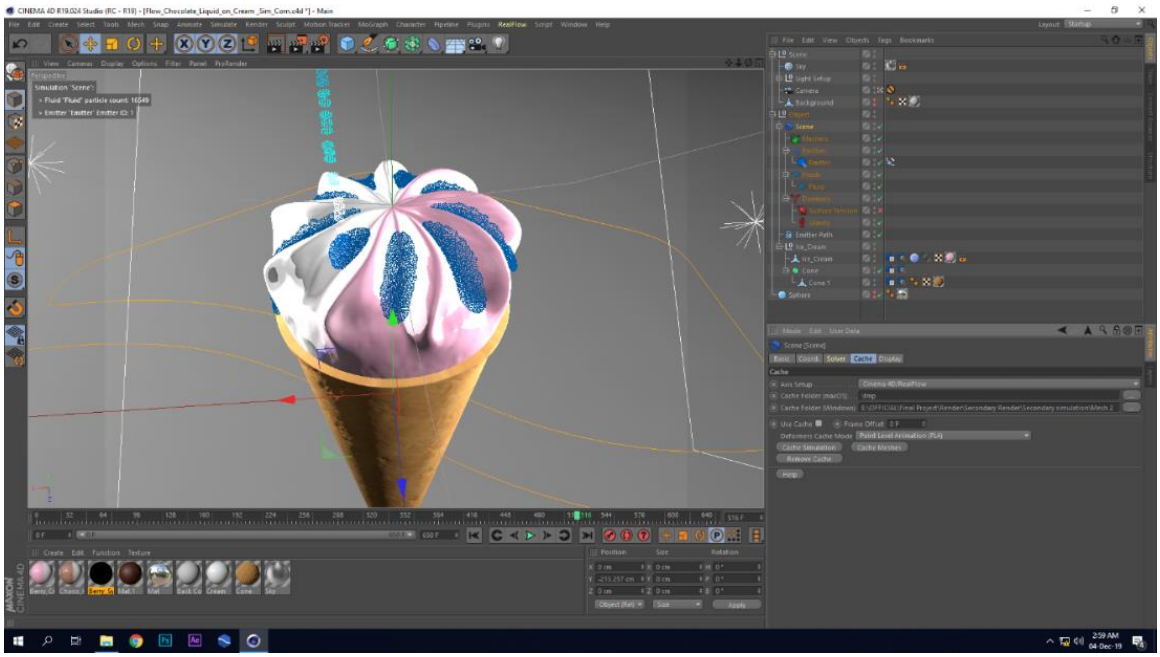

Figure 4.13: Particles Caching

Step 7: Particles was converted the to mesh by a mesher. Topology preset was set to Quads, resolution to low-medium. Radius and smooth was set to 6 to get creamy look.

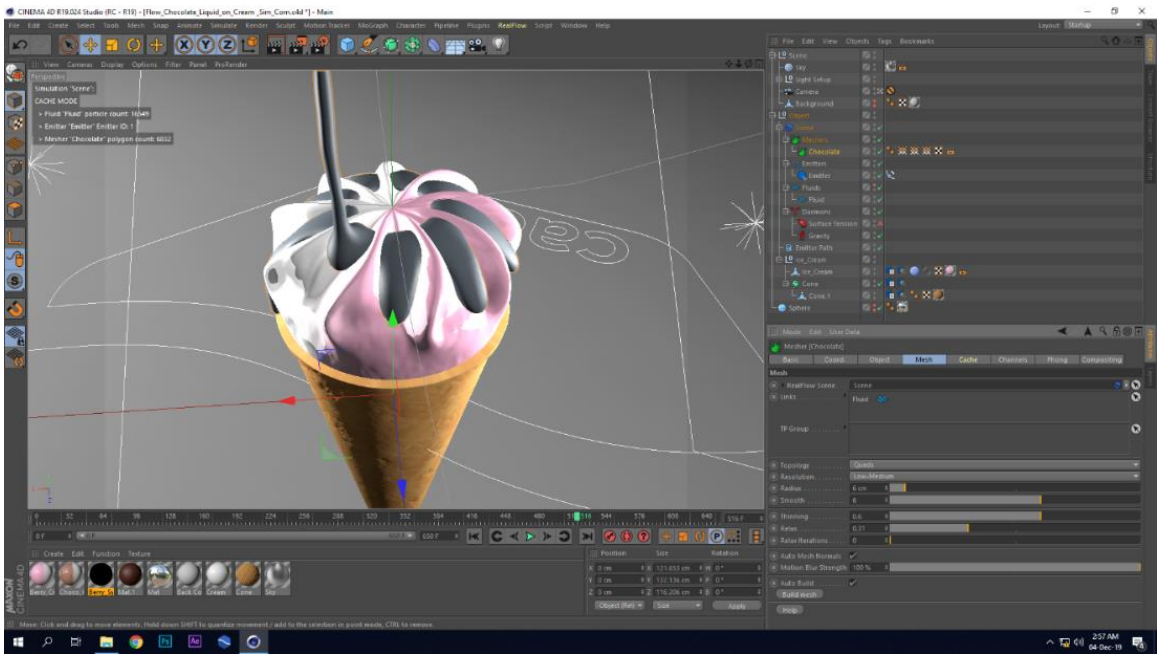

Figure 4.14: Mesh of the Syrup Flow

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Step 8: After tuning filter like thinning and relax mesh was cached from cache tab.

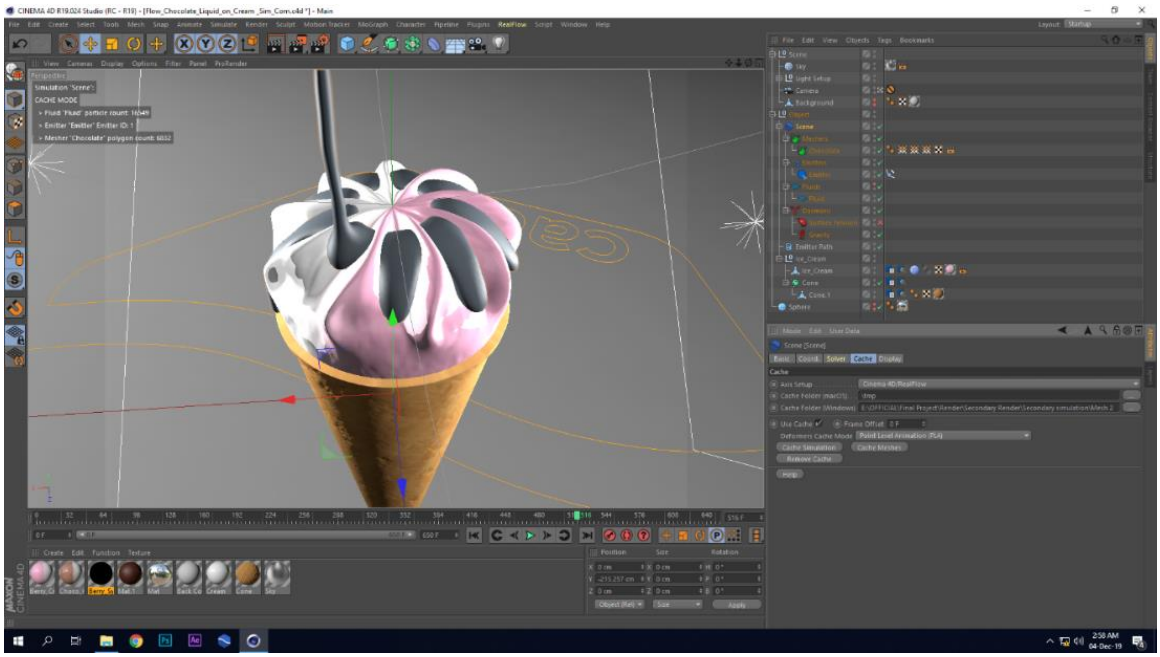

Figure 4.15: Caching Mesh

Material

Step 1: Red was chosen for syrup color from HSV of color channel. Pezo noise shader was taken as texture to create fluid pattern over color.

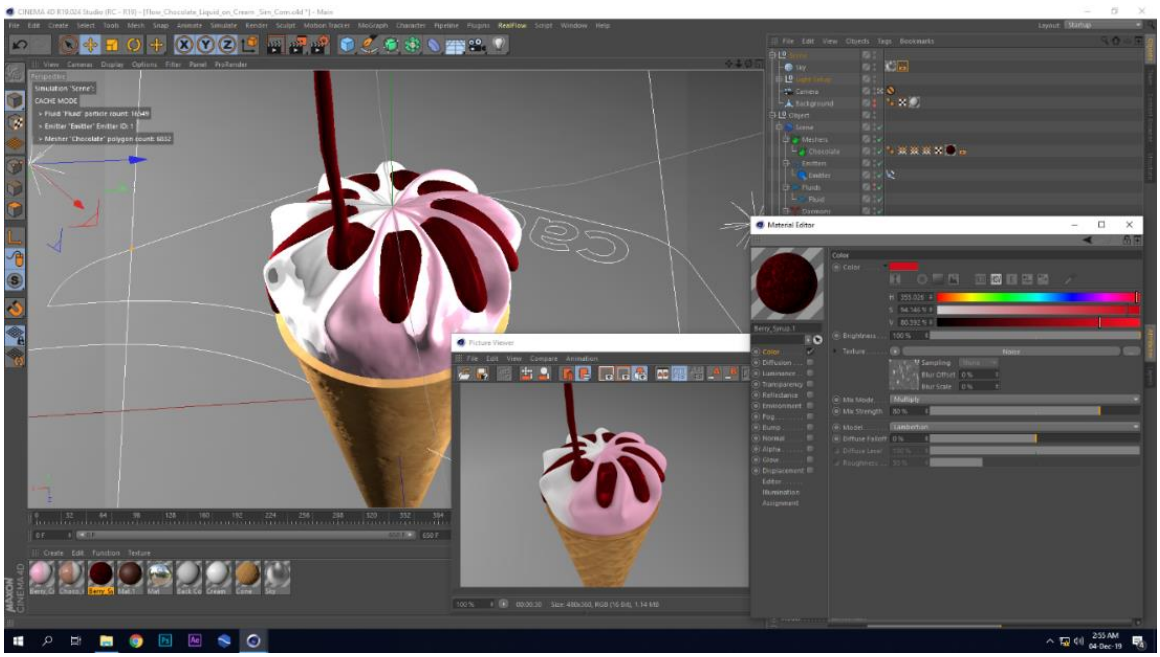

Figure 4.16: Color Channel on Syrup Flow

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Step 2: Pink color chosen as color for luminance channel to illuminate a pinkish light.

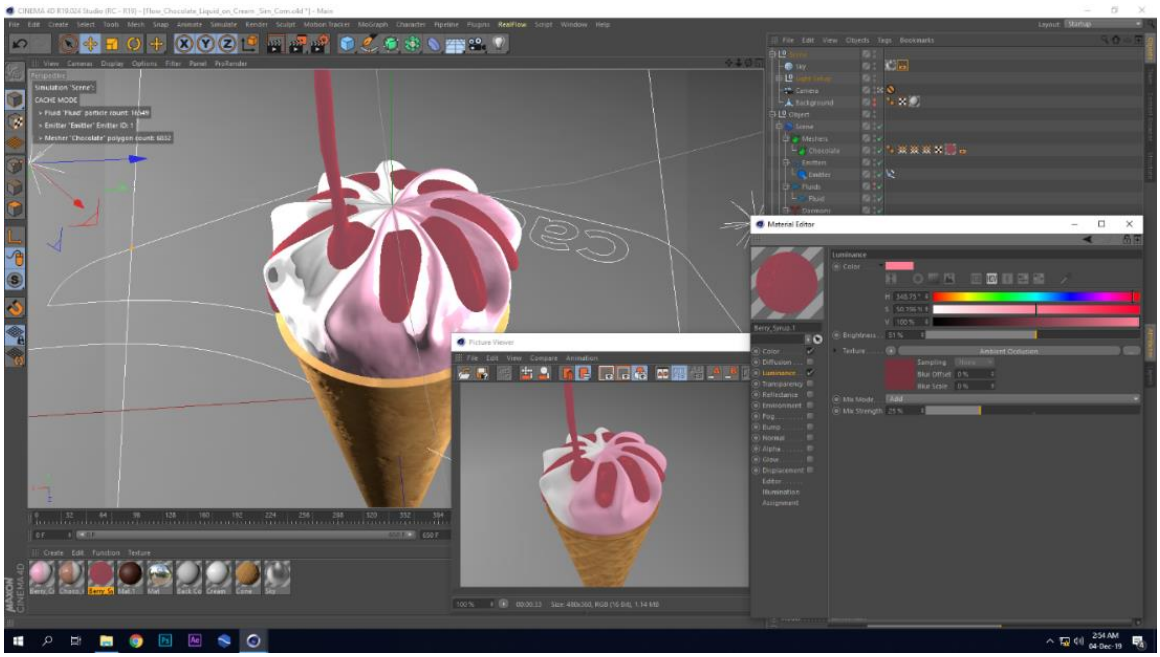

Figure 4.17: Luminance Channel on Syrup Flow

Step 3: Pink was the color of transparency channel and darker pink was the absorption color with absorption distance of 3 cm so that the color of syrup started to be darker pink from pink as it goes further than absorption distance 3 cm.

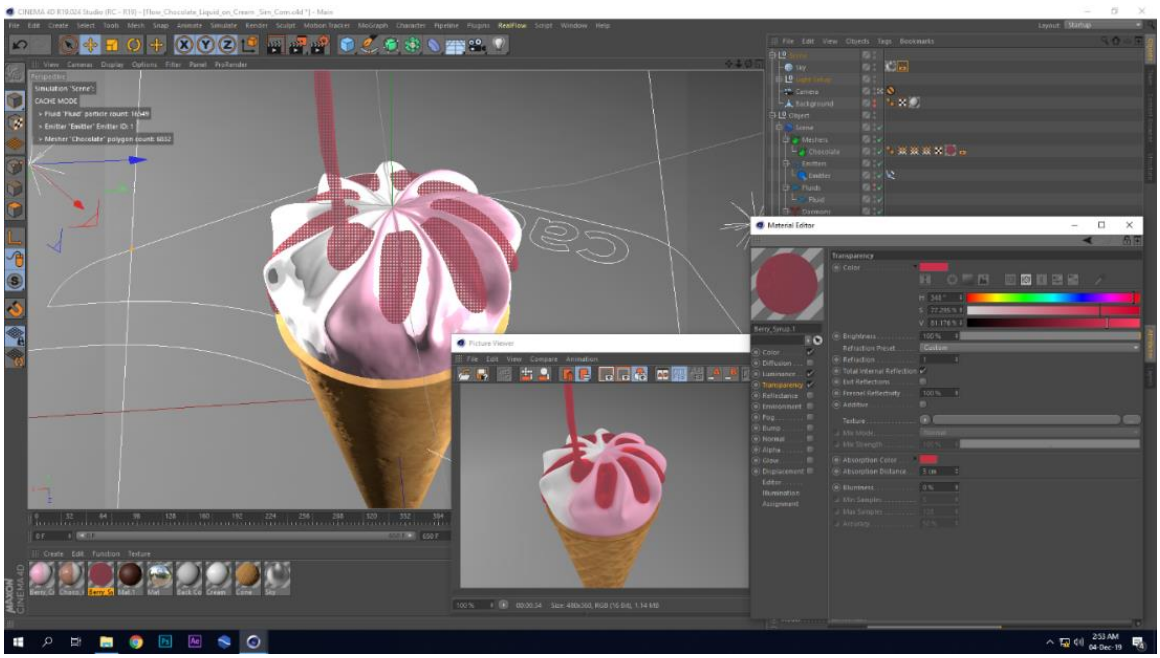

Figure 4.18: Transparency Channel on Syrup Flow

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Step 4: Beckmann along the default specular preset was chosen as reflectance shader from reflectance. Beckmann had a brightness about 10% to have a minimum reflection.

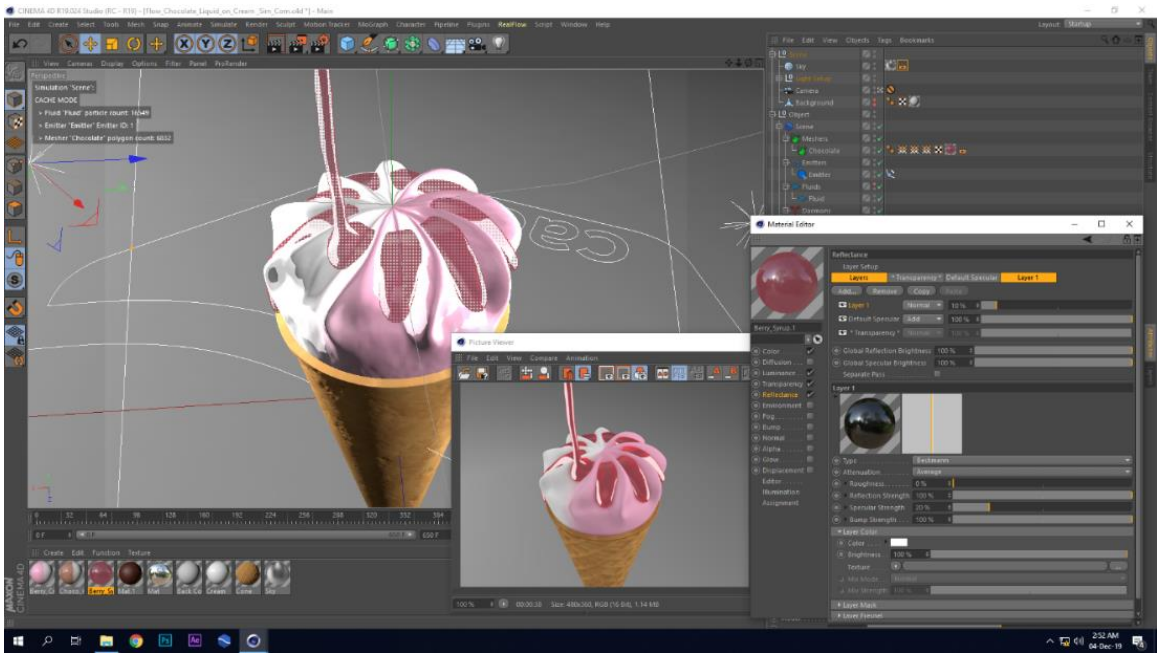

Figure 4.19: Reflectance Channel on Syrup Flow

Step 5: Poxo noise shader was chosen in the bump channel to have a little bit bumpy surface. Irregular reflection on the syrup surface was the result of little bump effect.

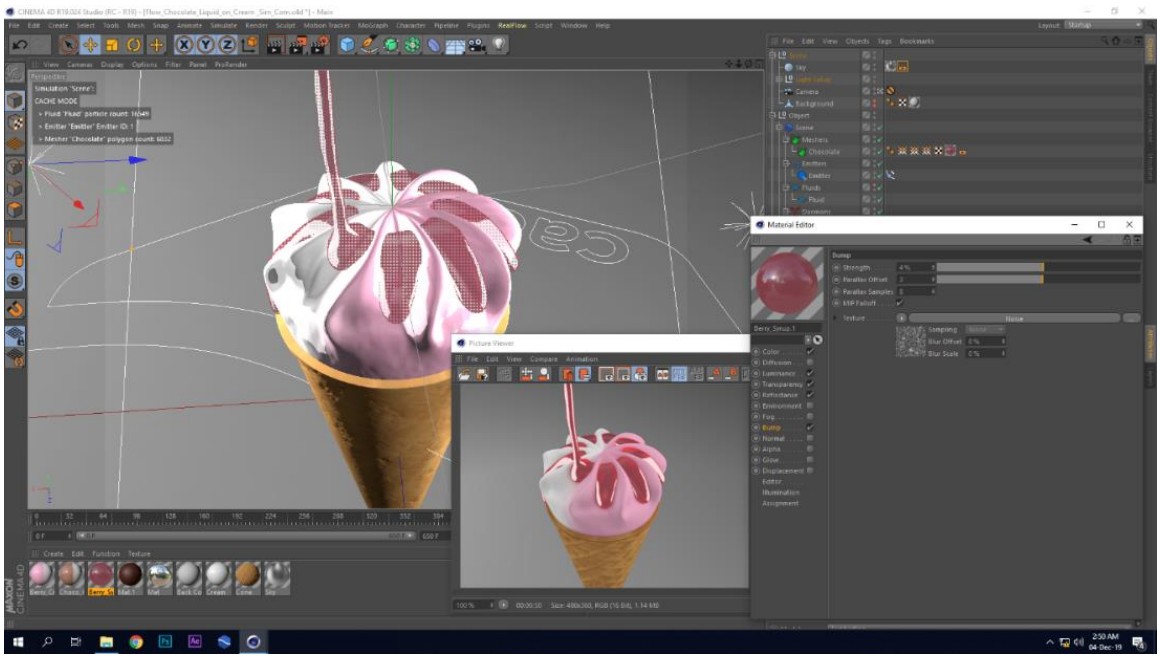

Figure 4.20: Bump Channel on Syrup Flow

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4.2.2 Chocolate syrup

Same steps were followed to create the chocolate syrup as in the strawberry syrup.

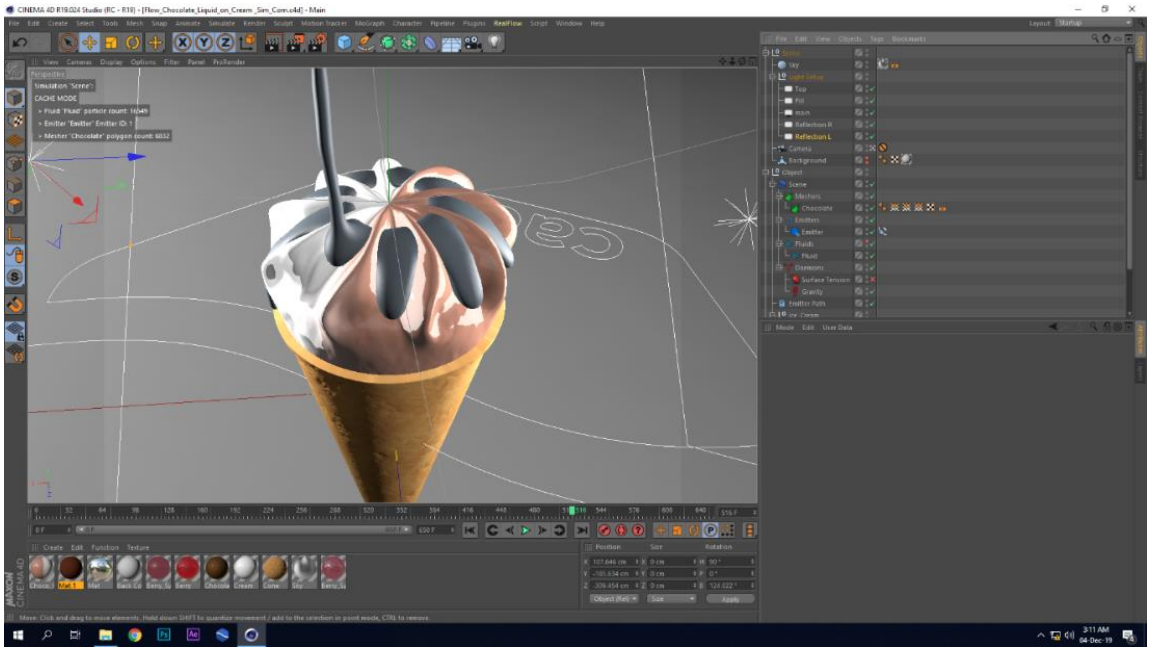

Figure 4.21: Mesh for Chocolate Syrup

Material

Step 1: Chocolate color chosen from reference image by color picker of color channel.

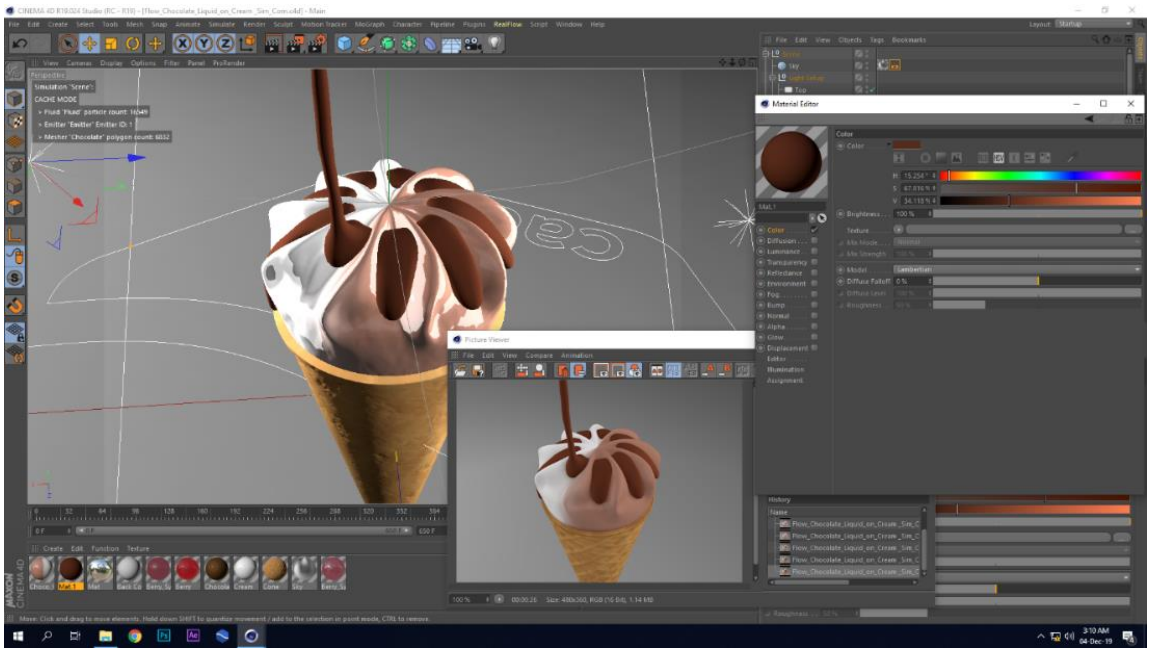

Figure 4.22: Color Channel on Chocolate Syrup Flow

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Step 2: Beckmann preset was taken over the default specular preset.

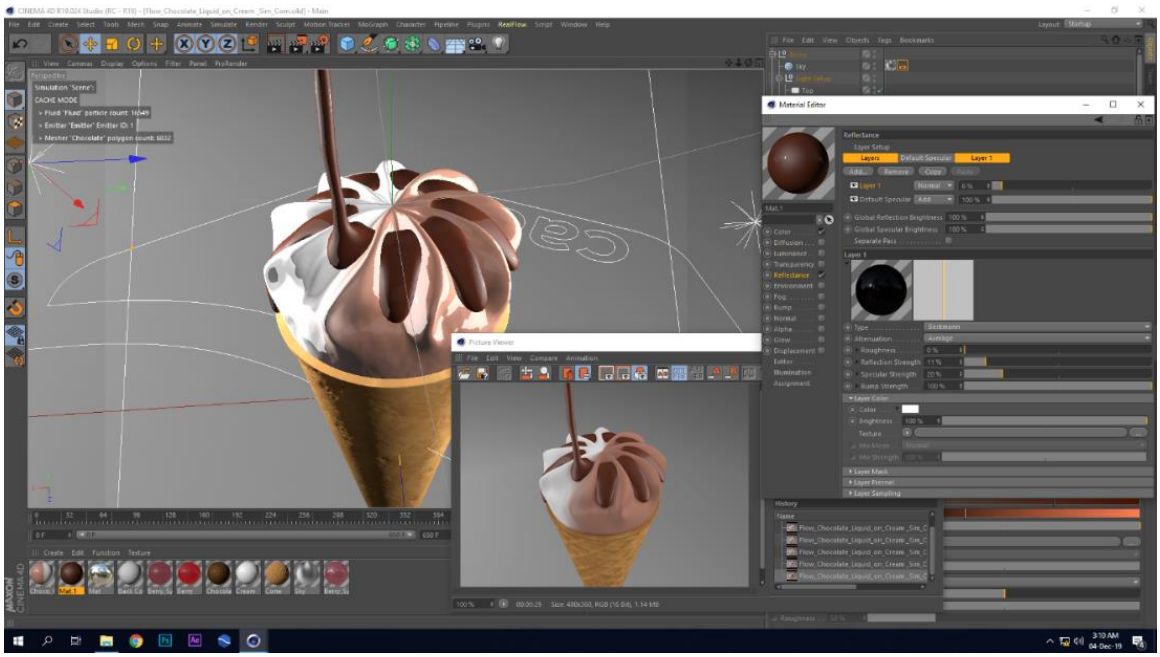

Figure 4.23: Reflectance Channel on Chocolate Syrup Flow

4.3 Peanut Simulation

Step 1: Peanut fracture, ice-cream model and baked syrup was imported to a new scene.

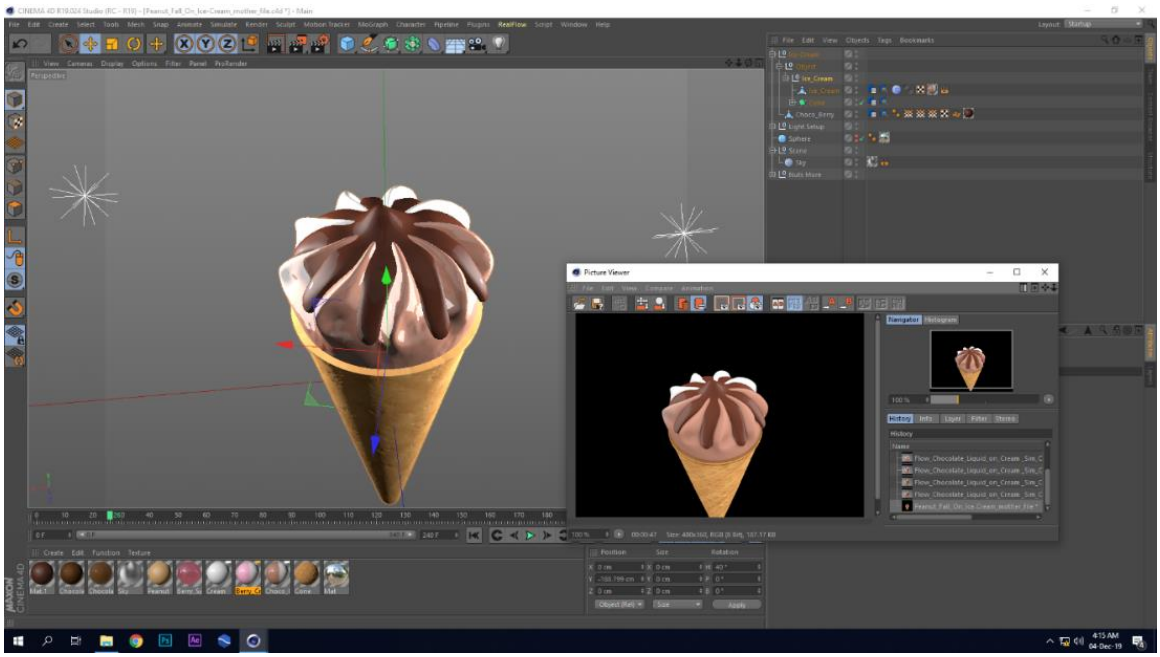

Figure 4.24: Ice-Cream and Syrup Model

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Step 2: A huge circle emitter was taken to create the peanut fall simulation.

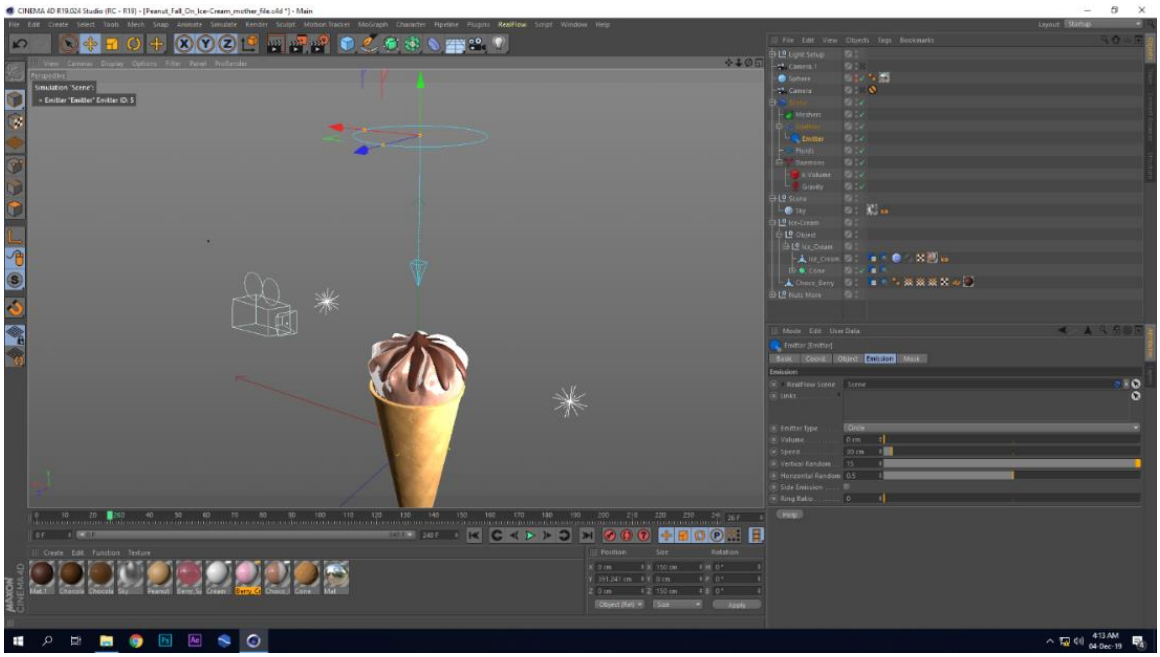

Figure 4.25: Emitter for Peanut Fall

Step 3: liquid-PBD was chosen with Int Pressure of 1 to have internal force.

Step 4: Peanut fractures were linked to the fluid to replace the particles with peanut fractures. In particles tab of fluid object position and rotation random was tweaked.

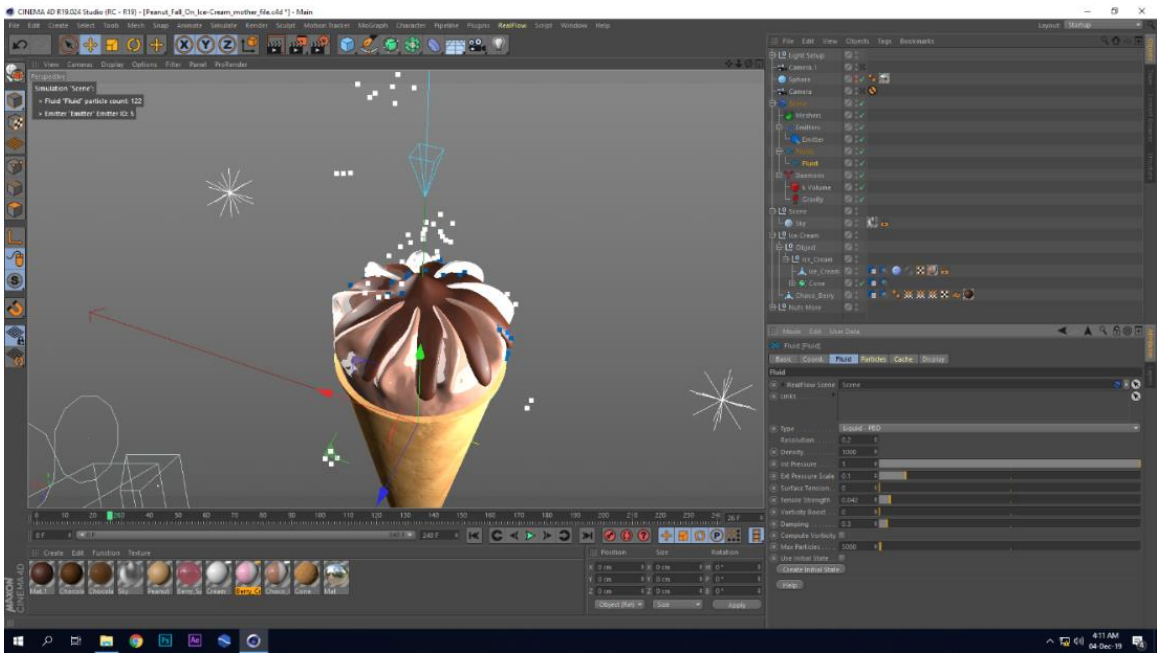

Figure 4.26: Particle Emission from Emitter

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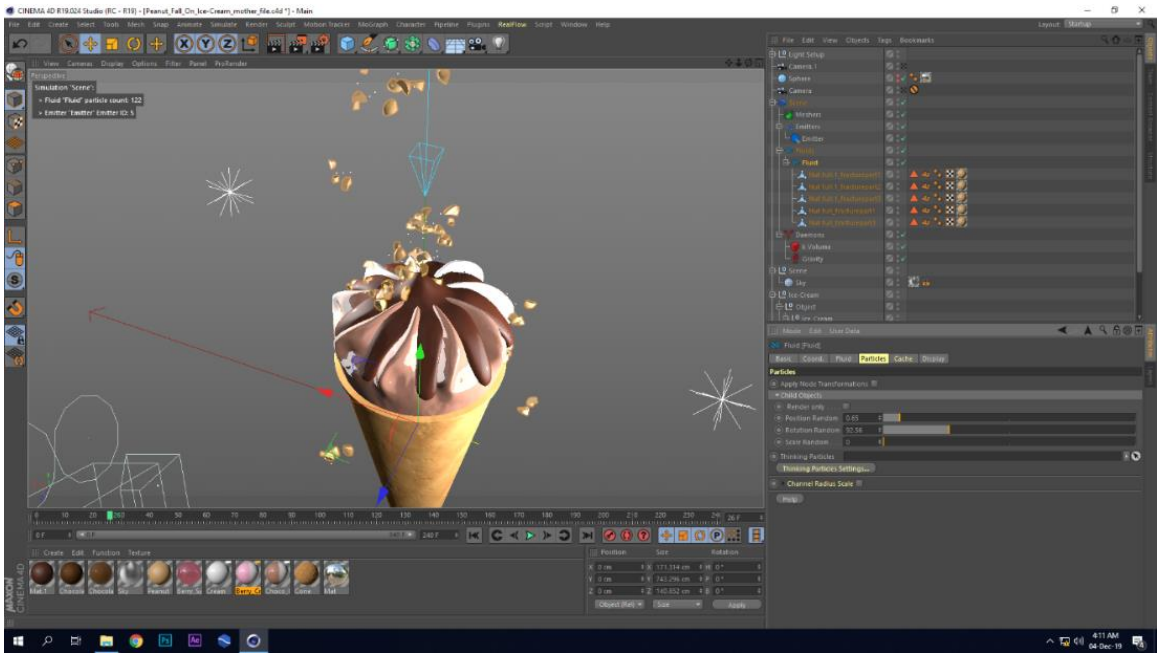

Figure 4.27: Particle Replaced by Peanut Fracture

Step 5: When I got the appropriate collision between peanut and ice-cream, clicked the cache simulation button to save the collision and deformation.

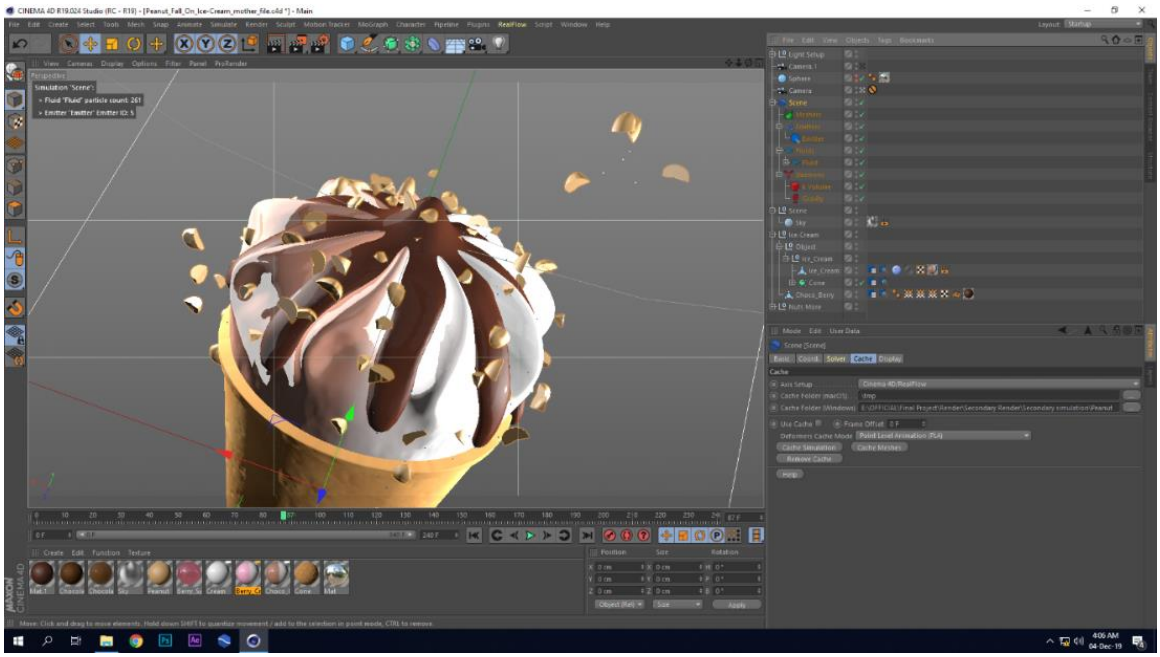

Figure 4.28: Caching Peanut Simulation

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CHAPTER 5

RENDERING AND COMPOSITING

In this chapter render setting, rendered images, final composition has been discussed. Also, the final composition process has been discussed. Physical renderer in cinema 4D was used as the render engine. Physical renderer is the easiest and lightest render engine available in the cinema 4D. My project is about a visualization of two flavored ice-cream. This visualization mainly has two side one is chocolate and another is strawberry. And every side have 3 scenes and 2 common scenes including 8 shots. Scene and shots are named after by their characteristics. Scene wise Render setting and rendered images will be shown here:

5.1 Scene_1: Flow

Scene_1: Flow is all about falling down denser milk on the cone and the creation of the ice cream. This scene is a major scene in my visualization and it contains 5 shots. It is also important for its duration compared to other.

5.1.1. Shot_1: Macro

Shot_1: Macro is the starting shot of scene_1. Here close up shot has chosen to show the characteristics of the flow from top view.

Figure 5.1: Scene 1 Shot 1 Strawberry

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Figure 5.2: Scene 1 Shot 1 Chocolate

5.1.2. Shot_2: Flow Down

In Shot_2 flow of denser milk towards the cone has showed form the top view. A full shot from top view shows its spiral flood of milk holding strawberry and chocolate. It's the longest shot compared to other.

Figure 5.3: Scene 1 Shot 2 Strawberry

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Figure 5.4: Scene 1 Shot 2 Chocolate

5.1.3. Shot_3: Spiral

In shot_3 Side view shows the spiral creamy milk flow. This shot shows the same flow as shot_2 from a different angle of view. In this shot cone model is more visible than before.

Figure 5.5: Scene 1 Shot 3 Strawberry

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Figure 5.6: Scene 1 Shot 3 Chocolate

5.1.4. Shot_4: Towards Cone

In Shot_4 Camera was moved towards the cone from bottom of the cone towards inside. Camera started its journey from the outside bottom and its destination is inside the cone. It's totally a different angle which added another dimension to the scene.

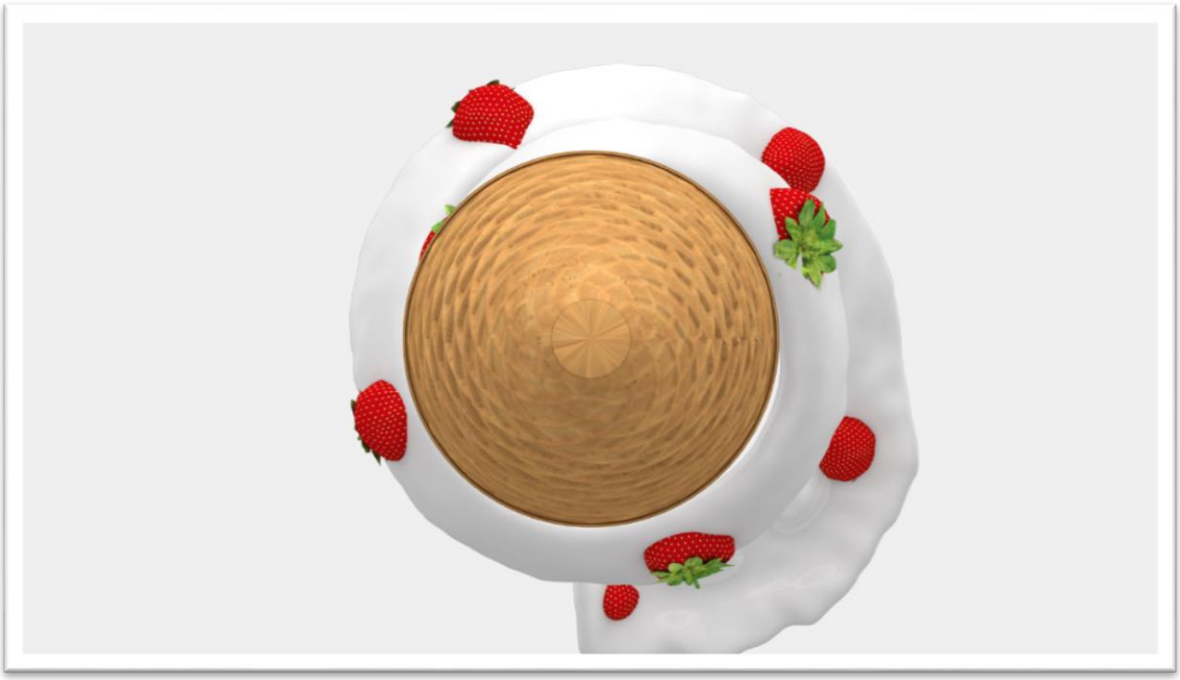

Figure 5.7: Scene 1 Shot 4 Strawberry

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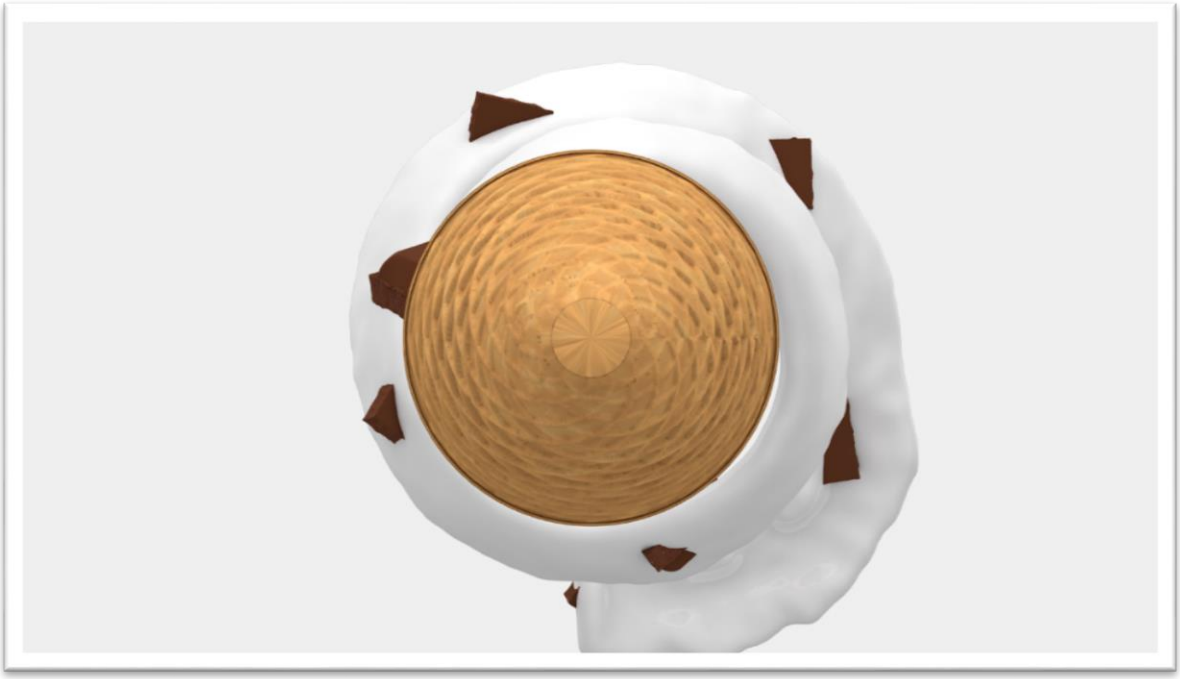

Figure 5.8: Scene 1 Shot 4 Chocolate

5.1.5. Shot_5: Inside the Cone

It continued the last shot when it reached the outer surface of the cone. It shows the pouring of denser milk in the cone to form cream. It had created a circular cropped frame where flow containing strawberry and chocolate seemed very surprising.

Figure 5.9: Scene 1 Shot 5 Strawberry

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Figure 5.10: Scene 1 Shot 5 Chocolate

5.2 Scene_2: Fall

In scene_2 the ice-cream is already formed from the flow of denser milk. There are two flavored ice-cream strawberry and chocolate. Two types of syrup were fallen down over the ice-cream.

Figure 5.11: Scene 2 Shot 1 Strawberry

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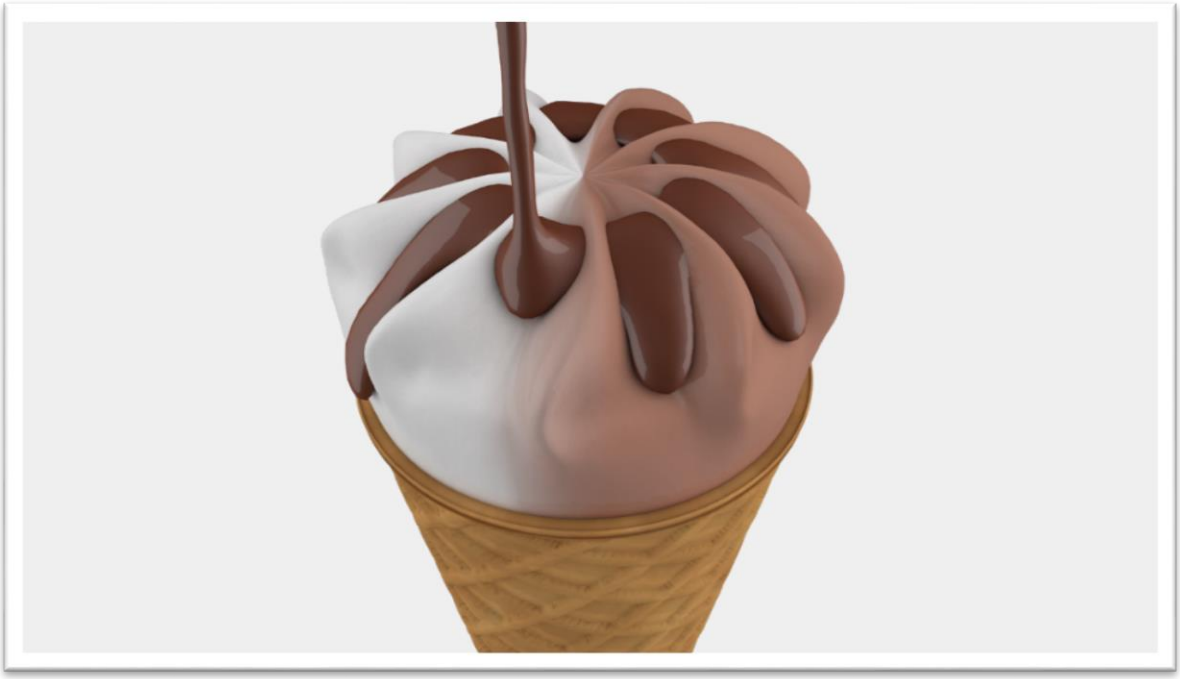

Figure 5.12: Scene 2 Shot 1 Chocolate

5.3 Scene_3: Mix

In this scene peanut simulation was happened. Simulated random peanut fall over the ice cream model. Some peanuts get bounced by the ice-cream surfaces and some stacked to this. All the fractured peanut fell upon the continuously rotated ice-cream.

Figure 5.13: Scene 3 Shot 1 Strawberry

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Figure 5.14: Scene 3 Shot 1 Chocolate

5.4 Scene_4: Connect

In this shot two flavored ice-cream was rushed to the same position. Then it became still and name of the flavor came out from the left side. Two text was colored with chocolate and strawberry color.

Figure 5.15: Scene 4 Shot 1

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5.5 Scene_5: Logo

In this scene with the appearance of company logo the visualization will be finished.

5.6 Render Settings

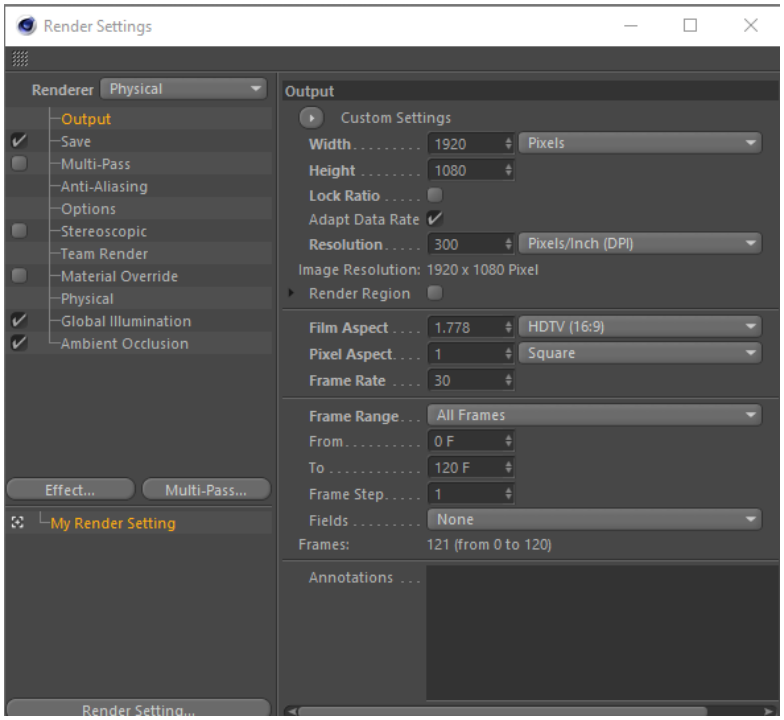

Figure 5.16: “Output” in Render Setting

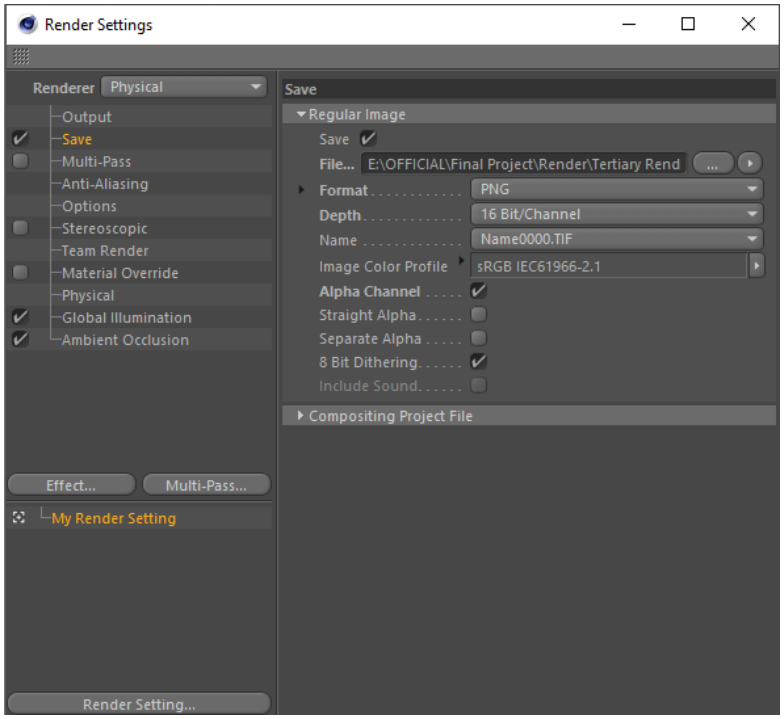

Figure 5.17: “Save” in Render Setting

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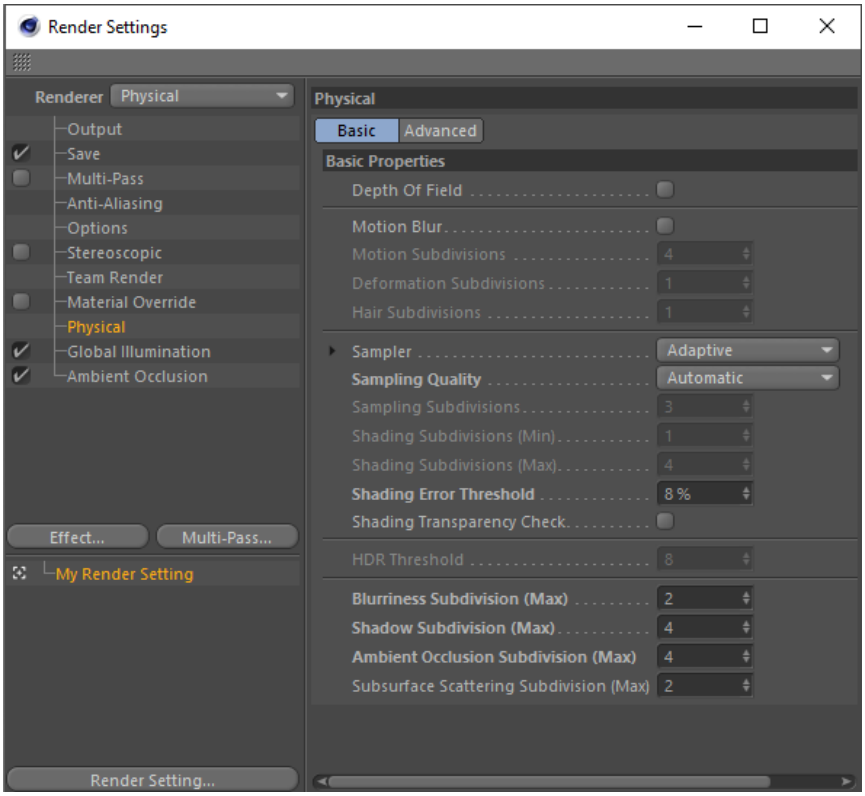

Figure 5.18: “Physical” in Render Setting

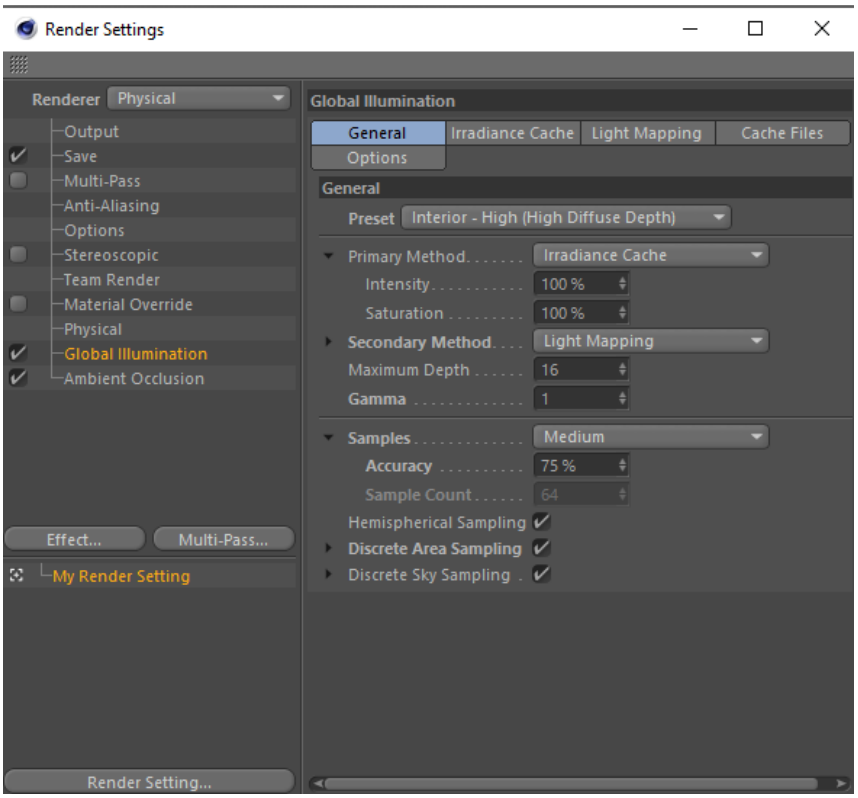

Figure 5.19: “Global Illumination” in Render Setting

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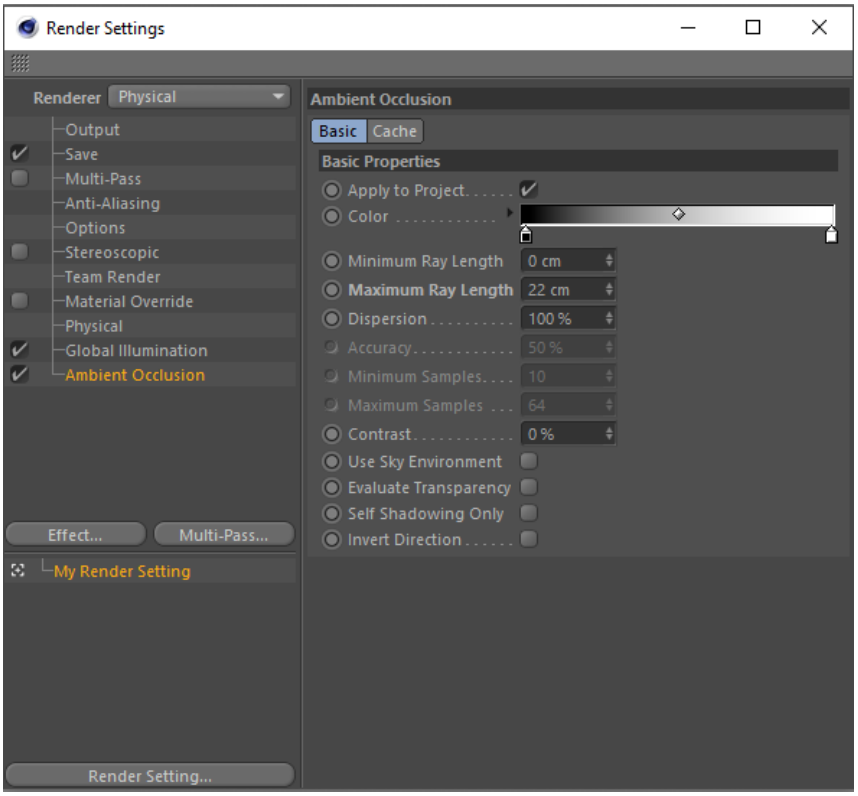

Figure 5.20: “Ambient Occlusion” in Render Setting

5.7 Compositing

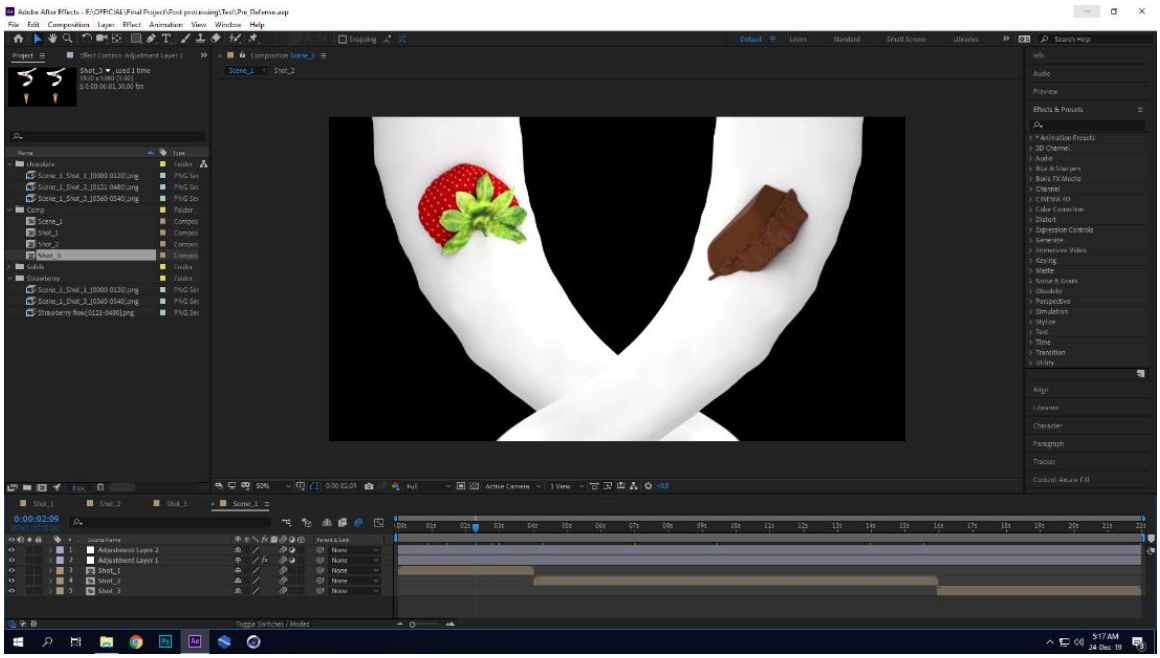

Figure 5.21: Compositing software AE

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CHAPTER 6

CHALLENGES AND SOLUTIONS

Every mistake is an opportunity to learn something new. Materializing an idea is not as easy as planning. Giving form to my idea was not much easy. There I had to face several problems, confusion and error in my project. Some problems happened due to my mistake and ignorance in the workflow. Though every problem killed my time and energy I become able to solve and avoid them next time. In this chapter challenges I had faced and solutions will be discussed.

6.1 Calyx's Texturing Problem

In my project the simplest looking but time-consuming model is the calyx of strawberry. I had to go through the trial and error process again and again for this particular model to finalize. Two polygons were kept unselected during polygon edge cutting in the texturing process of calyx. I tried to select these two polygons individually that was hard to do. And after selecting place them in right place with their neighboring polygons was challenging task. So, there was no texture on these two polygons.

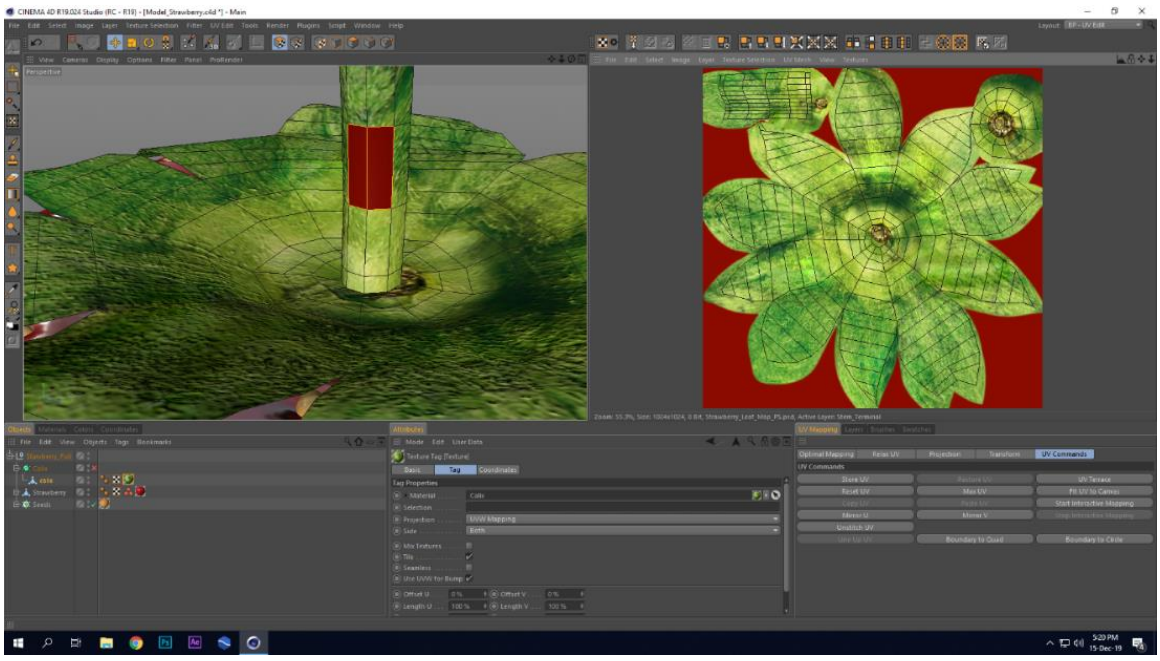

Figure 6.1: Calyx's Texture Problem

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Solution

I chose the “UV Terrace” command from the UV command panel by selecting those two polygons. The command applied to move them to their neighboring polygons which is their actual position. That worked for me and I became able to avoid running UV mapping process again.

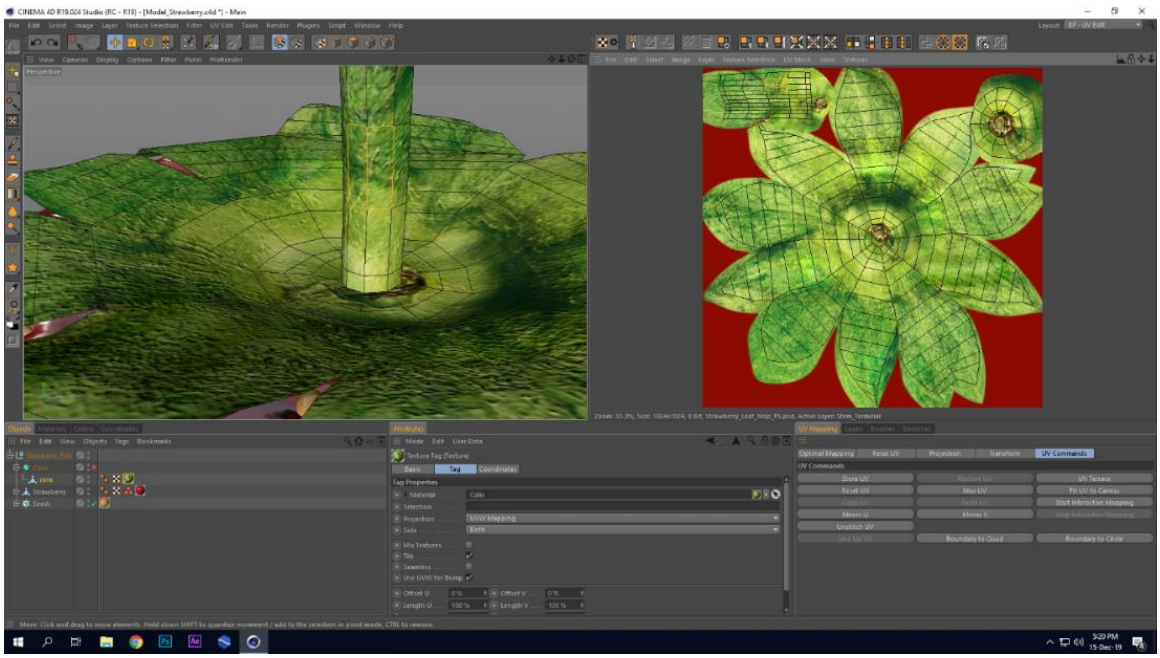

Figure 6.2: Calyx’s Texturing Problem Solved

6.2 Displacement Map Problem

Two problems and their solutions related to the displacement map will be described here. One is about the displacement map shortage and another is about the lack of realism due to not having a gradual effect.

6.2.1 Displacement Map Crisis

The ice-cream model has two parts. One is a cone and another is cream. The cone part needed a crossways pattern on it. So, I decided to use a texture in the displacement channel of the material editor. I tried to have knowledge about the pattern type and angle between intersecting lines. So, I searched for the texture on the web. I found many of them but they are not appropriate for my look. I decided to make one for me.

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Solution

I created a pattern by applying the "Cloner" function on two intersecting cubes with a certain angle. As the displacement map pulls and pushes the polygons according to the white and black value of the texture. Several trial and error happened to find out the proper greyscale value for the pattern I was creating for the displacement map. Finally, I got my proper displacement map.

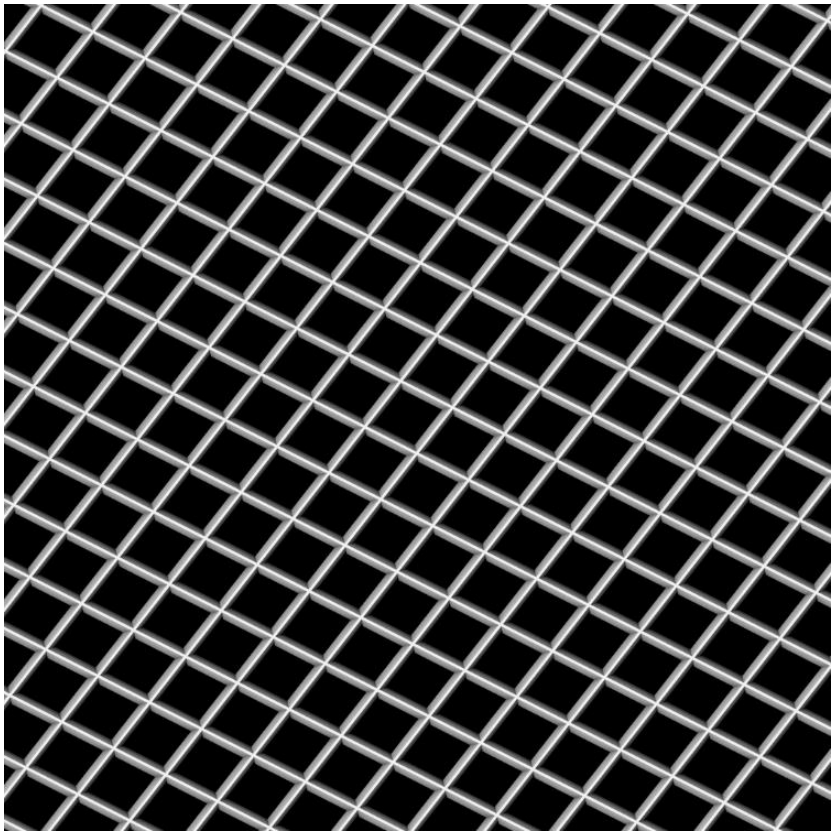

Figure 6.3: Greyscale Image of Displacement Map

6.2.2 Unrealistic Displacement Map

The second problem is unwanted same displacement all-over the cone. But in real cone of the cone ice-cream the bumpy pattern gradually lessened towards the bottom part of the cone. Real cone also has some surface micro notches and random scratches which need to be mimic in the model to get a realistic model. I tried every option related to the map to create a gradual effect on the cone. I wished that the displacement will gradually lesser towards the lower part. But I searched for the solution of that problem in material editor but failed to find the solution there.

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Solution

I decided to have a gradual effect on the greyscale image. I imported the greyscale image in Photoshop and added a black fill layer over that. A mask had been added to the fill layer. Alt + left click on the mask made the starting of editing the mask. Then added a linear black and white gradient to control its opacity according my desire. A particular brush stroke also been added to the mask to slightly randomize mask effect on the fill layer. This randomized effect of displacement map created some irregular extrusion towards the bottom of the cone. Finally, I got the gradually lesser effect of displacement map towards lower part which gave me the wanted result.

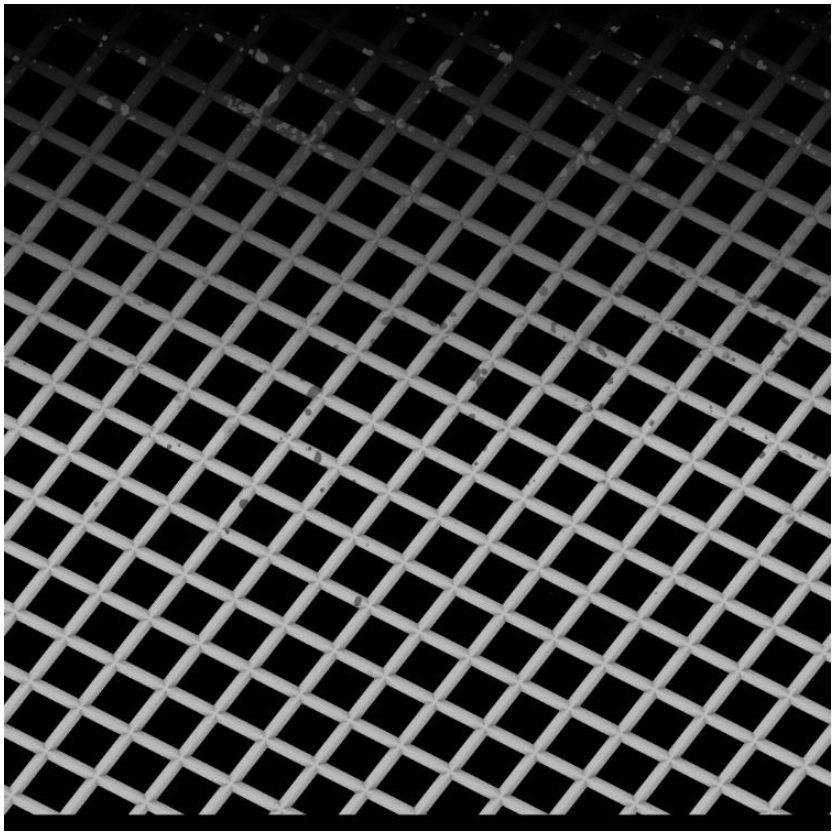

Figure 6.4: Gradual Effect of Displacement Map

6.3 Gradient Problem

The ice-cream model has two parts, one is brown cone and another is multicolor cream. As the visualization is based on the ice-cream of two flavor. Each ice-cream will have a white cream part and a color according flavor. If the flavor is chocolate then the cream

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model will have a gradient of white and chocolate color or if the flavor is strawberry then the cream model will have a gradient of white and pink color. Finally, I added gradient to each cream model according flavor but the gradient was not properly fitting up. There, a line was seemed which was dividing the material in the lower part of the cream model unwantedly. I have tried every single tiling type in gradient shader. Nothing gave me the desired result. I didn't think about the material tag will be the solution here. So unwillingly I ignored the material tag and didn't try to find solution there.

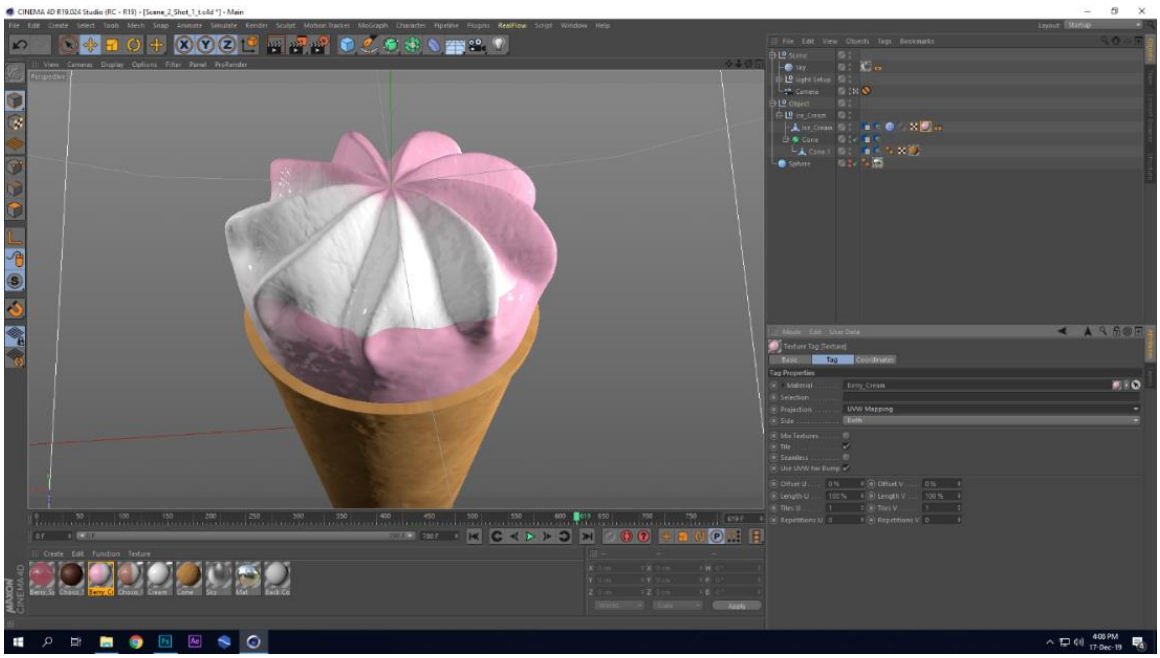

Figure 6.5: Improper Projection "UVW Mapping"

Solution

After wasting a great amount of time in searching the solution I found out the projection option in texture tag. In the texture tag there were several options for the projection of material over the model surface. Then I tried for every projection type to see which one works for me. After checking them all I become able to determine that I should select the projection type to cylindrical which will give my desired look. Then I had chosen the cylindrical as projection type and it was really worked. Then there was no line which was dividing the material. And material was projected over the cream model seamlessly. Final fine-tuning happened by tweaking some parameters of gradient shader.

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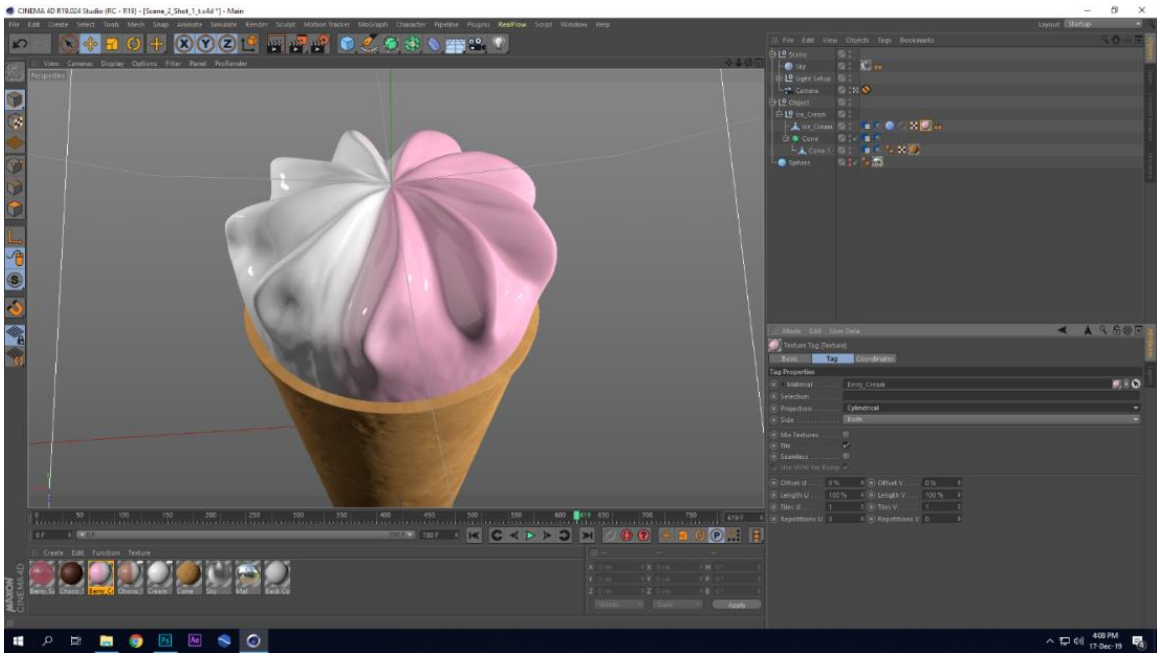

Figure 6.6: Proper projection “Cylindrical”

6.4 Improper Strawberry Model to Hold Seeds

Symmetrical seed placement over the strawberry model which is unnatural.

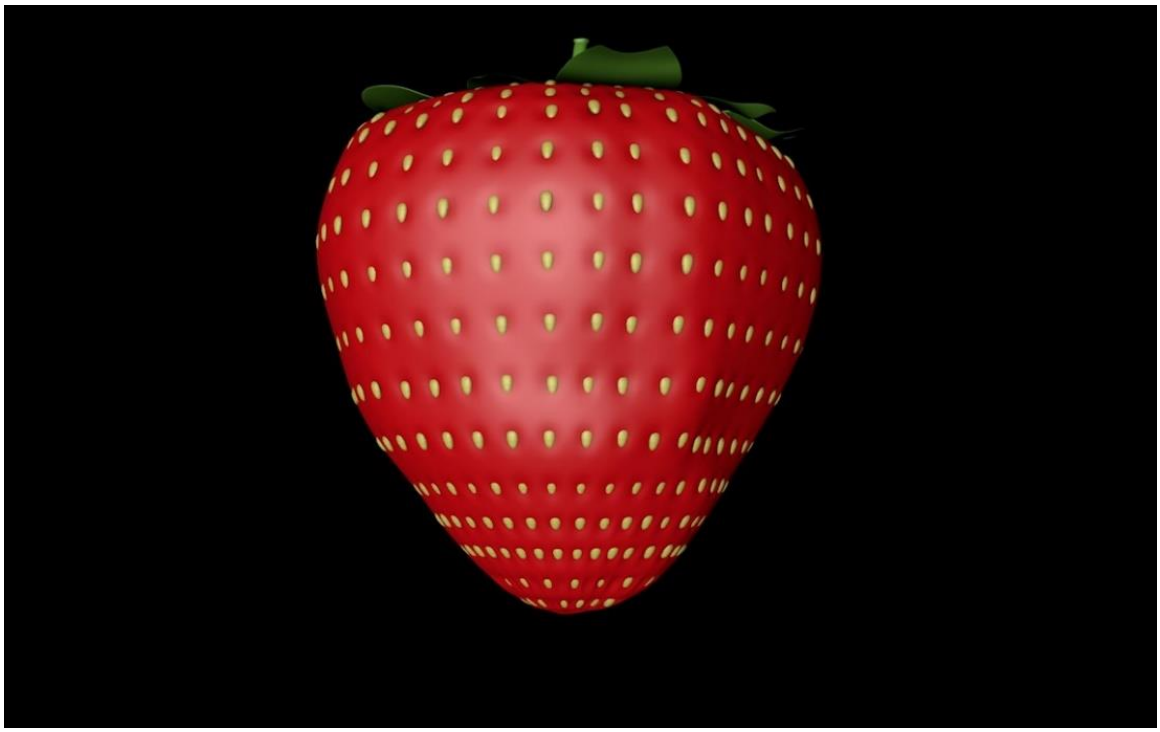

Figure 6.7: Symmetrical Seed Placement

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Strawberry is a crucial model in my project. At first, I made a strawberry model from a sphere object. Though the model was nice, seed placement on this was not pleasant. Generally strawberry has a lot of notches over the fruit body surface to hold the seeds. But creating those notches over the surface of my strawberry model manually is very time consuming and seed placement become symmetrical on this model which is unnatural.

Solution

I chose sphere type icosahedron which gave me the option to place the seeds asymmetrically on the strawberry model surface. First of all, I formed the model from an icosahedron object. Then selected all vertices on the surface and chose the set selection option from the select menu to keep the vertices selected. Applied the subdivision to get a smoother model. Finally scaled down those selected points to create notches asymmetrically to hold seeds.

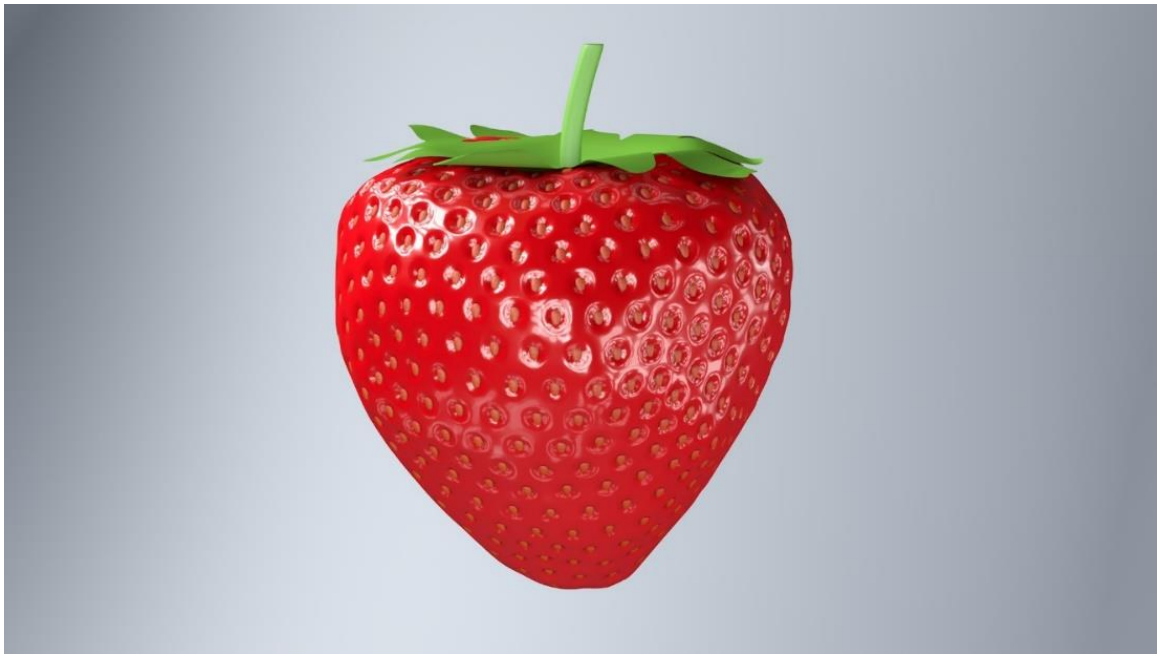

Figure 6.8: Asymmetrical Seed Placement

6.5 Main Flow Shape Problem

In my core simulation part, I made spiral shaped flow of cream. I got the spiral look by the Dspline daemon. But the radius of the flow was unwanted for me. The spiral of the

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cream was looking like an unwanted growing tube of cream. I want to flatten down the flow on “Y” axis. I wanted an irregular, non-uniform surface of the spiral shaped flow. So, I tried in many ways to get the desired look but failed.

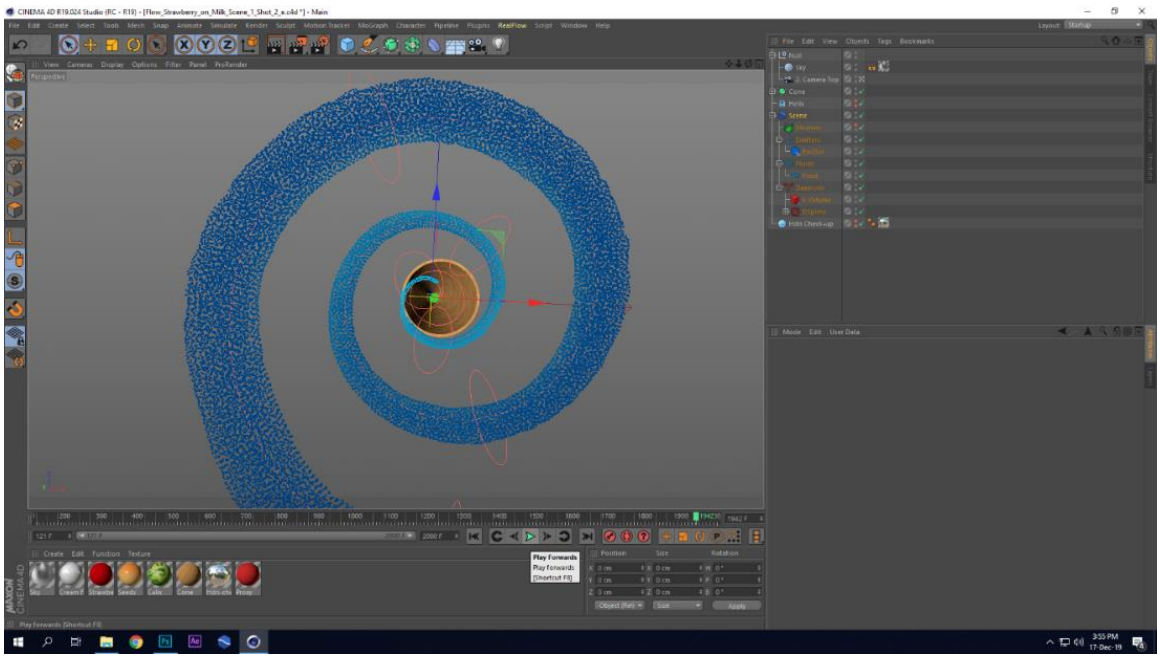

Figure 6.9: Spiral Flow with Normal Radius Top

Another angle may show the uniform structure of the milk flow properly which was unwanted. Desired look is flatter and wider flow of the denser milk.

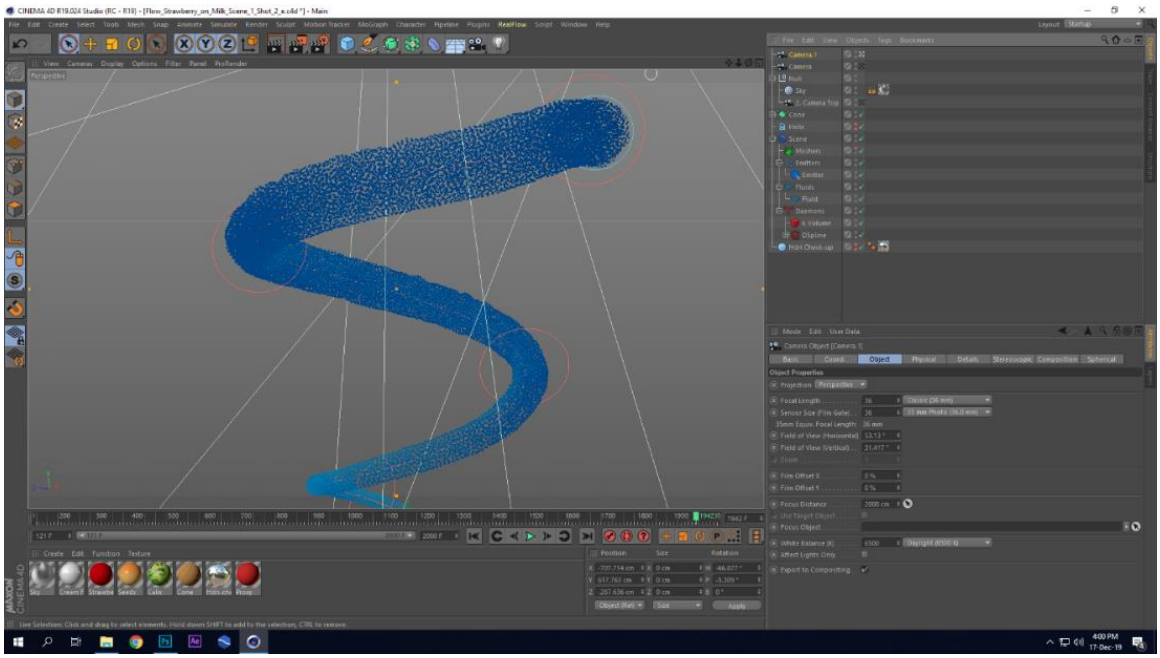

Figure 6.10: Spiral Flow with Normal Radius Side

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Solution

In the fluid tab of fluid object. Fluid type had been changed to “Viscoelastic” and emitter widen to make flow wider and non-uniform. Finally, I got the desired look by viscoelastic fluid type and widen emitter.

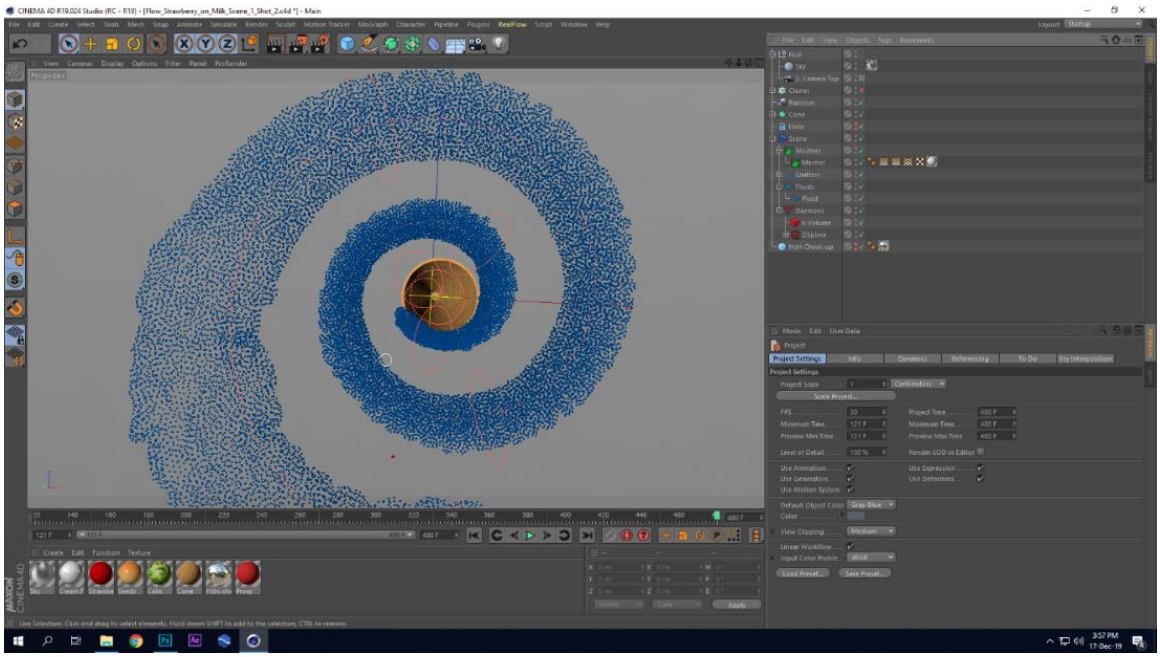

Figure 6.11: Flatten Spiral Flow Top

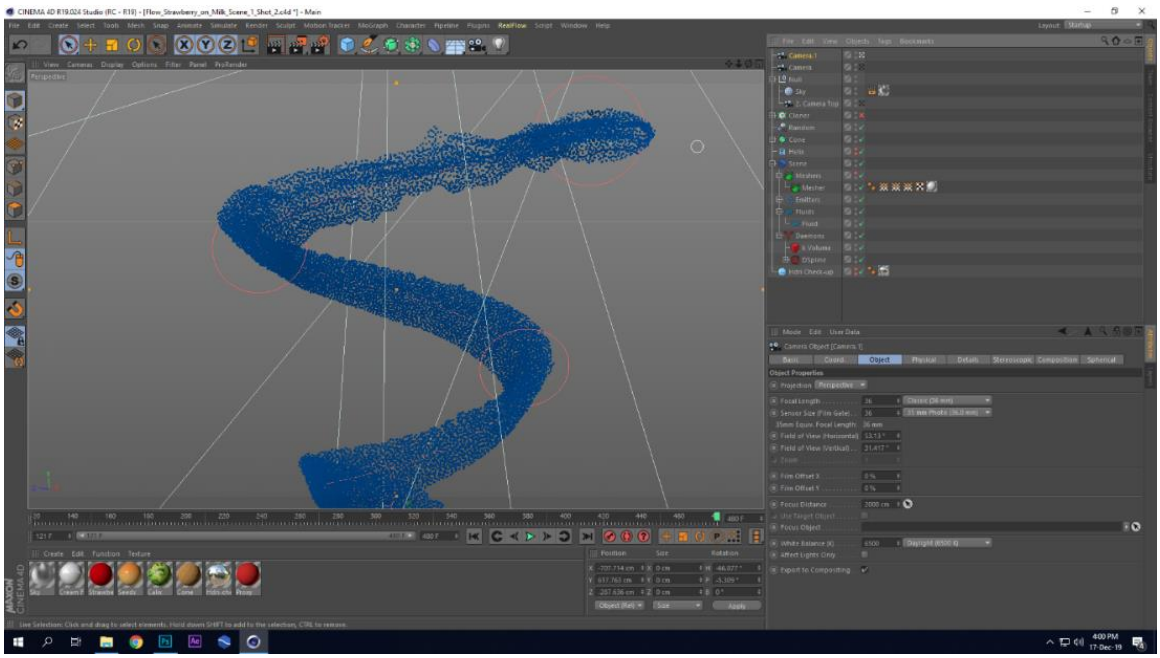

Figure 6.12: Flatten Spiral Flow Side

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6.6 Incorrect Reflection

Almost in every material I had used “GGX” as the reflection preset in reflectance channel. It was okay for some of my less reflective material but I became frustrated when I had used it for more reflective material. Reflection was not accurate with proper lighting setup. I was avoiding “Beckmann” preset for its highly reflective nature. I did not realize that it can be used for any object with controlled value. I had also changed illumination of the sky but the result was overexposed Scene.

Solution

I played test over my models to determine where to use what. After a several times trial I got my answer and finally decided to use “GGX” preset for less reflective material and “Beckmann” preset for more reflective material.

6.7 Camera Direction Problem

In a scene camera movement was from bottom outside of the cone towards inside of the cone of ice-cream model. In viewport everything seemed to be okay. The rendered image seems to be okay when the camera is outside the cone.

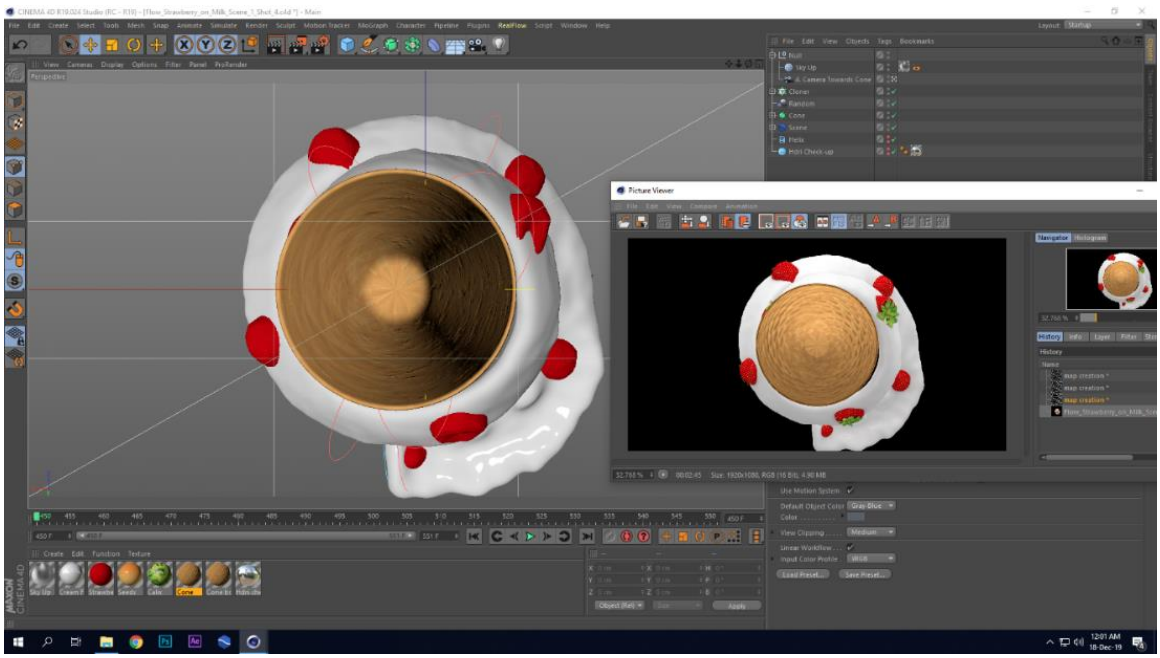

Figure 6.13: Outside Rendered Well.

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But the rendered image turns to fully black when the camera was inside the cone. Objects, material, light, camera settings, render setting and normal direction had been checked out. But I couldn't find out the problem what actually it is

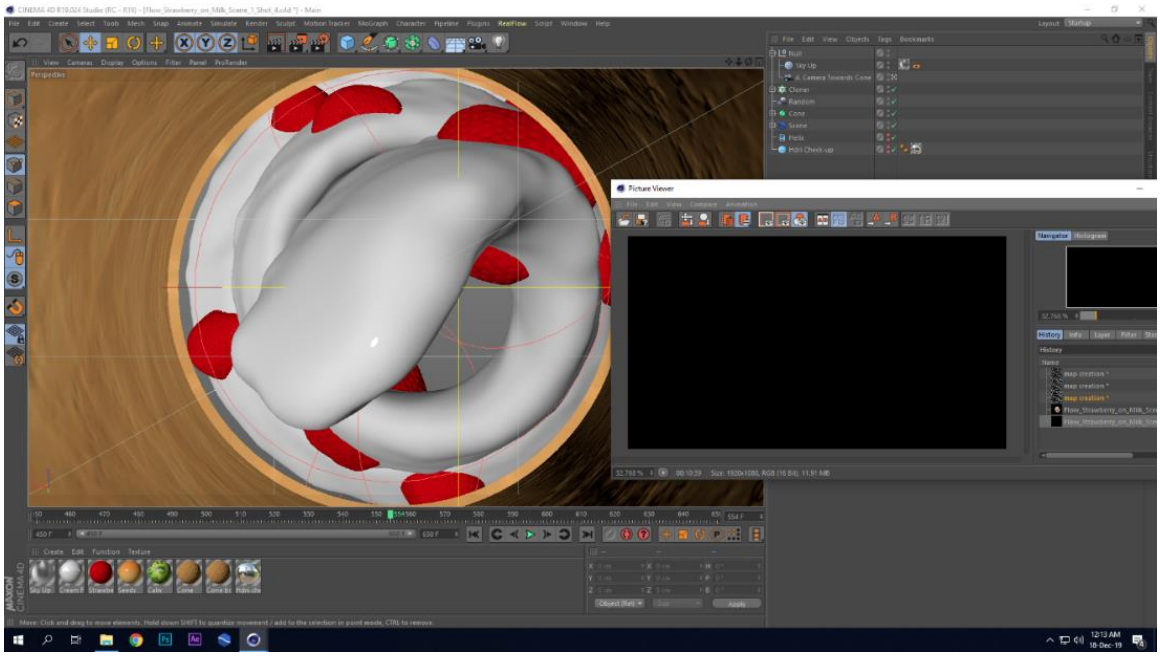

Figure 6.14: Inside Rendered Black

Solution

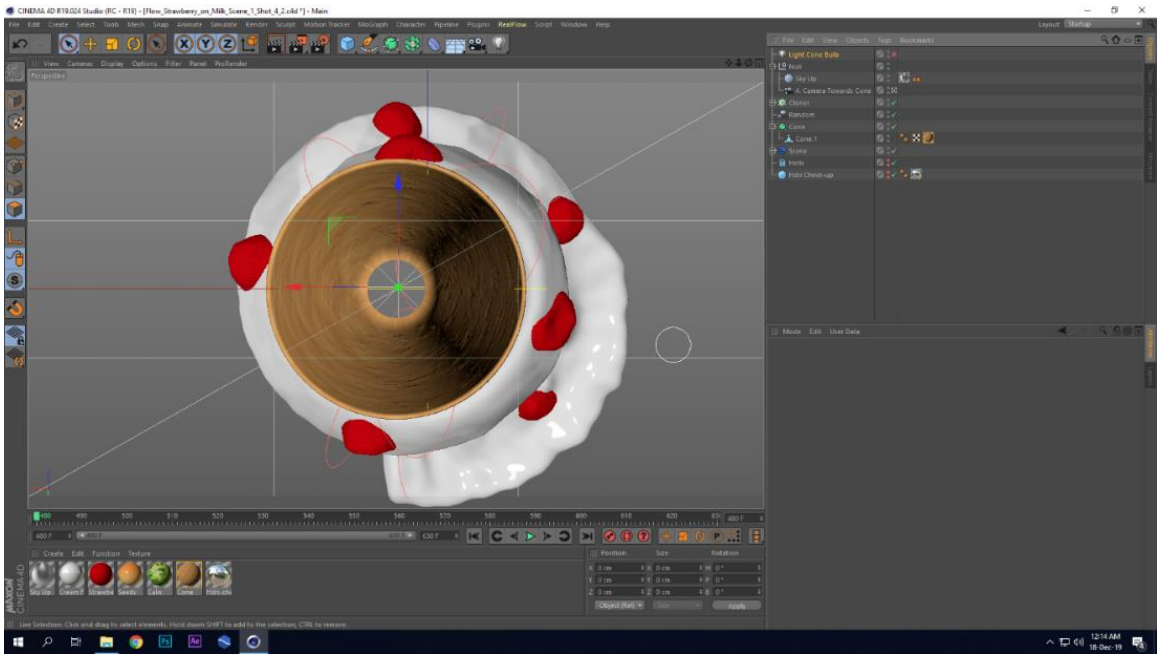

Figure 6.15: Polygons Deleted to Create Hole

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After wasting plenty of time I discover the solution. Suddenly I realized I should delete the polygons within which the camera goes through. I did as I had thought. And after deleting those polygons where the camera was entering into the cone then the rendered image inside the cone behaved correctly.

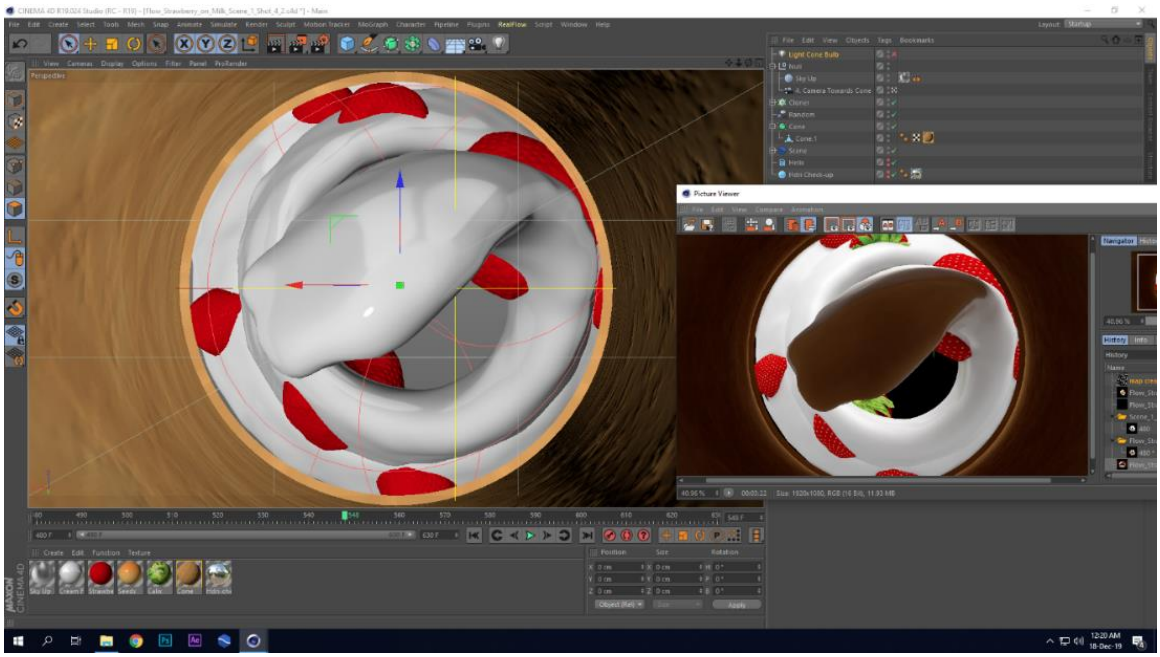

Figure 6.16: Inside Rendered Well

6.8 Frame Rate Mismatch

Frame rate has a great impact on final rendered image sequence or video. Frame rate define that how many frames or moving images will pass within a second. Generally, in cinema 4D default frame rate is 30 fps. In one of my project file frame rates had been changed from 30 to 24 fps. After the frame rate being changed the animation was not playing correctly. I solved the problem temporally by changing the timeline frame count without paying much attention to this problem. I had suffered from two different problem due to same mistake that is frame rate mismatch.

6.8.1 Simulation Caching Problem

Frame count in the cache file was unwanted when I cached the simulation of this project. As frame rate determine the frame count for each second. So, with the alternation of frame rate cached frame count became unwanted.

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6.8.2 Rendered Image Sequence problem

The rendered images or footage behaved incorrectly when I played test render on a sequence.

Solution

One step solution of this project is project frame rate, output frame rate and viewport frame rate should be same. Otherwise, unwanted result will not be a wonder. It is a good habit to synchronize the frame rate everywhere in project file before the work started.

6.9 FBX Format Problem

All the models of my project were made separately. I had exported the models in FBX format and imported them in the target project file. The strawberry model was imported to a project file. Material of strawberry seeds had a gradient shader in color channel. Imported FBX file did not have the gradient shader in the strawberry seed material. I solved this problem temporally by manually made a copy of seed material to the project file. It was time consuming and improper way to deal with that problem.

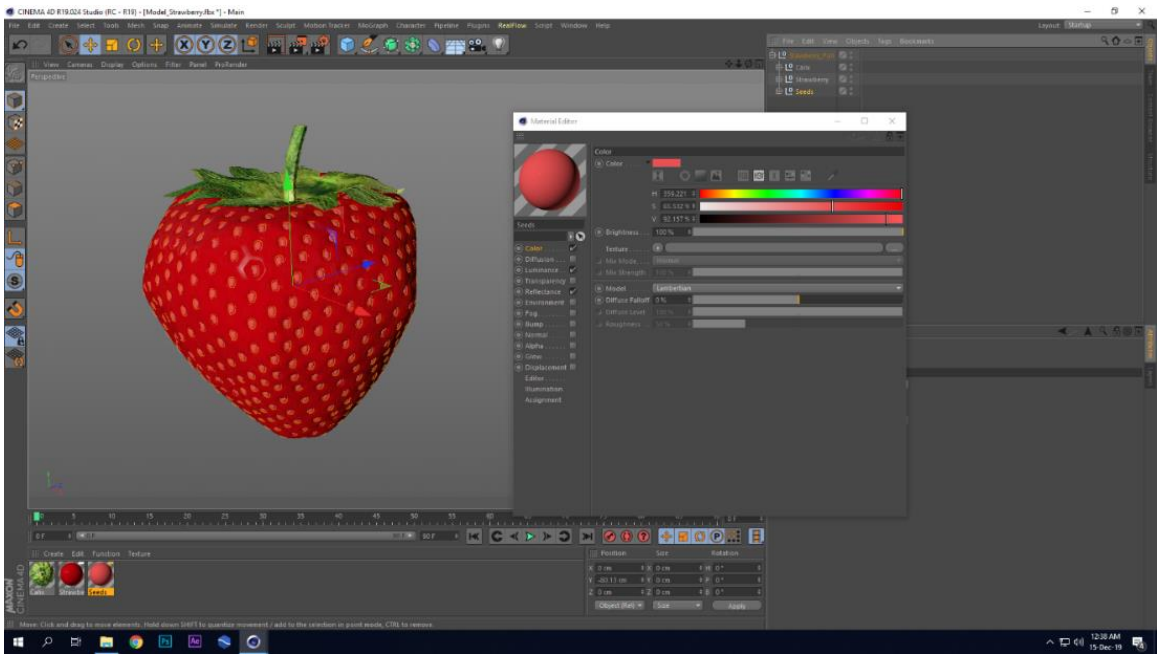

Figure 6.17: Gradient Missing in FBX Format

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Solution

Use “Merge” option in the file menu to merge the file that contained model to project file is the best solution to this problem. This solution worked for me in this certain situation. But when the source model file will contain plural number of models, this solution may not suitable.

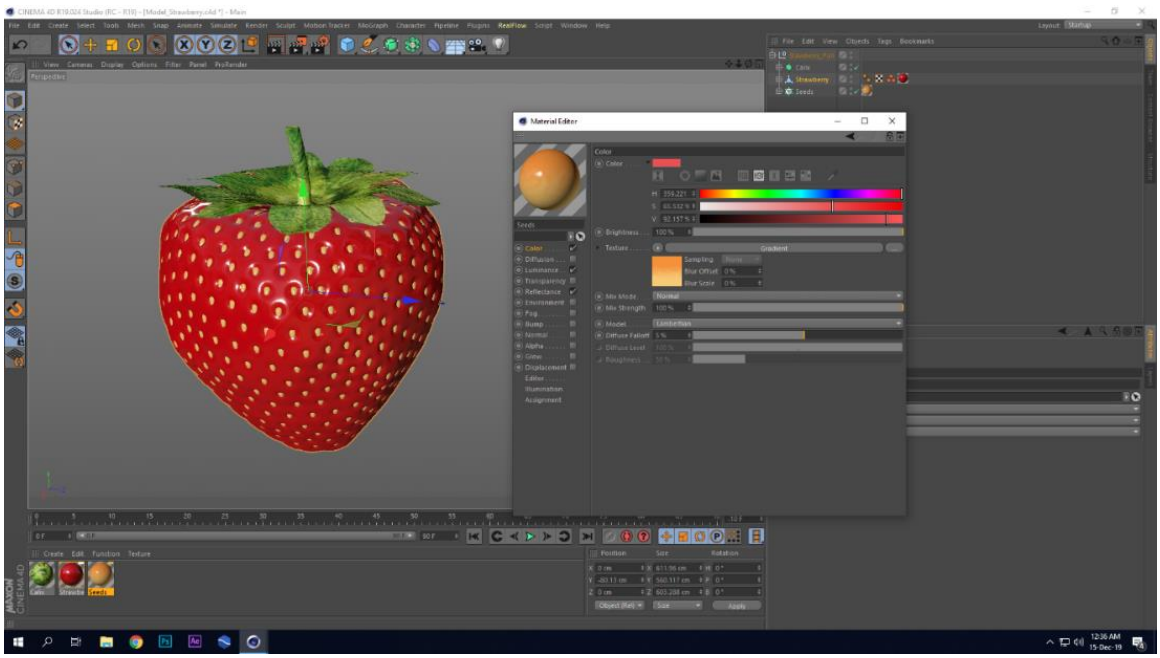

Figure 6.18: Gradient Remain with Merge Option

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CHAPTER 7

CONCLUSION

Workflow of my project, modeling technique, texturing process have been discussed in my project report. During this project I learned new techniques in sculpting, UV mapping, modeling. I did mistakes and learned the way to find the solution. I had tried to follow industry standard pipeline before started my work. And these developed my workflow than before. This report writing taught me to keep patience for long time with its production process.

In the commercial aspect, this work will help to draw the attention of consumer showing them the right attribute of a product within shortest amount of time. Simulation-based TVC is mostly straight forward to give info to the viewer with its appealing visuals. companies or brands are able to advertise product spending less money with less duration by product visualization and simulation technique. Mistakes made a finer path for me to learn better by this project. In personal aspect using simulation as the main tool to visualize will help me to follow world standard market path.

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