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The Supremacy of Amphiphiles: Annihilating the Coronavirus

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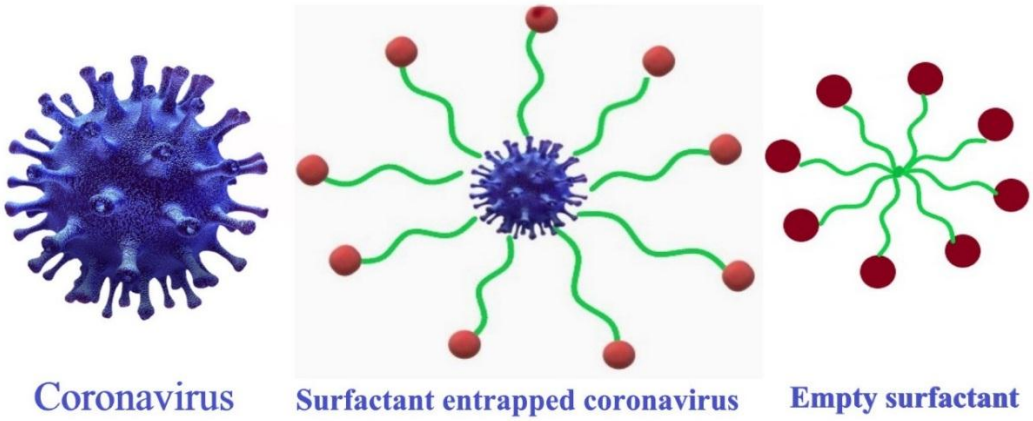
ABSTRACT

The recently discovered coronavirus that causes coronavirus illness (COVID-19) is infectious. Individuals or the public can easily infect by novel COVID-19 from a person already suffering from this virus. This coronavirus can blow out from human to human through saliva or mucus that comes out of the nose or mouth of a sick person when they cough or sneeze. In the current scenario, soap or amphiphiles were found to be very effective at stopping the spread of coronavirus. Soap is also known as "amphiphiles," having a characteristic of dual nature. The name amphiphiles are commonly used as a surfactant. Soap acts virtually like a crowbar towards coronavirus and hence currently the only protector of human society in this world.

Keywords: Coronavirus, amphiphiles, micelles, surfactants, aggregation, soap.



INTRODUCTION

Coronavirus: Most viruses, including the coronavirus, range in size from 50 to 200 nanometers, making them actual nanoparticles. Similar to viruses, nanoparticles have complicated interactions with surfaces. The coronavirus can infect both animals and humans. Recently discovered coronavirus is the cause of coronavirus illness. COVID-19. Prior to reports from Wuhan in December 2019, this coronavirus was unknown. On March 11, 2020, the World Health Organization proclaimed a global pandemic. Tiredness, aches, nasal congestion, sore throat, fever, etc., are the familiar symptoms observed in patients suffering from COVID-19. Most people, around 80%, recover from coronavirus disease without requiring special treatment[1]. Severe sickness is more likely to strike the elderly and people with conditions including diabetes, heart disease, chronic respiratory illness, and tumours[2].

More than one hundred coronaviruses spread among animals, including pigs, camels, bats, rats, etc. These viral outbreaks, sometimes known as spillover occurrences, occasionally infect people. This coronavirus can cause the common cold, Middle East respiratory syndrome (MERS), and severe acute respiratory syndrome (SARS).[3]

The virus is called coronavirus because of its shape, which resembles a crown with protrusions all around it (Figure 1).[4]

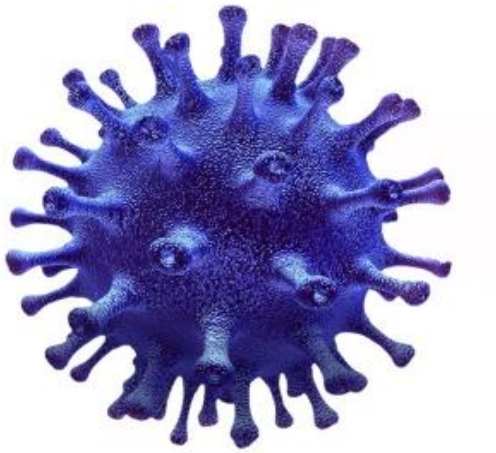


Figure 1: Illustration of the ultrastructure of the Covid-19 virus. (CDC/SCIENCE PHOTO LIBRARY)

Under a microscope, coronavirus is observed to have a crown-like look due to its appearance being covered in pointy spires, hence the name "corona". The virus's an outside coat, which is composed of lipids or, rather, fat, is located beneath the crown. Coronavirus possesses spikes structure on the surface which is responsible to infect the person, are enclosed into a membrane known as the shell. This portion of coronavirus is considered its weak point (Figure 2). People who have the coronavirus can easily

spread it by sneezing or coughing, or by hugging, shaking hands, or being in a crowded public place. Tiny droplets from a cough or sneeze can travel up

to 30 feet through the airways.

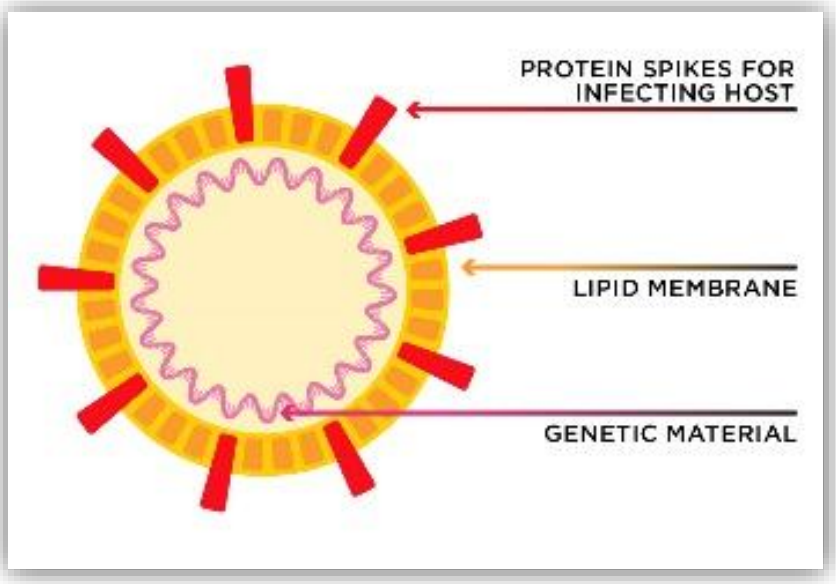


Figure 2: The detailed structure of coronavirus consisting of spikes made up of protein

(Source: Jonatahan Corum and Ferris Jabr/The New York Times)

Coronavirus can quickly grab skin as it consists of fatty acids and proteins. The skin layer may interact with the coronavirus via hydrogen bonding or hydrophilic interactions. The coronavirus will stick to a person's hand when touching a material surface. But still, the person is not infected by the virus. If some person's hands have coronavirus on them and touch his/her face, then definitely that person can get infected, and the virus can get transferred. Since most pathogens cannot enter the body through the skin's outermost layer due to its modest acidity, the coronavirus cannot. It is advised to wash your hands for a certain amount of time because of the rough and wrinkled skin so the soap can penetrate the skin's outermost layer. India has recorded 43979730 confirmed cases, 526258 deceased, 43309485 recovered and 143988 active cases, based on the most recent information from the Union Ministry for Health and Family Welfare on Jul 29, 2022.

Soap/ amphiphilic:

Paul Winsor first used the term "amphiphile" more than 50 years ago[5]. Additionally known as tensides or surface-active agents, amphiphilic (surfactant). Surfactants are a unique class of chemical molecules that exhibit both hydrophilicity and

hydrophobicity[6]. The combination of the hydrophilic (water-loving) head group and the hydrophobic (oil-loving) tail group is referred to as an "amphiphilic" structure [Figure 3].

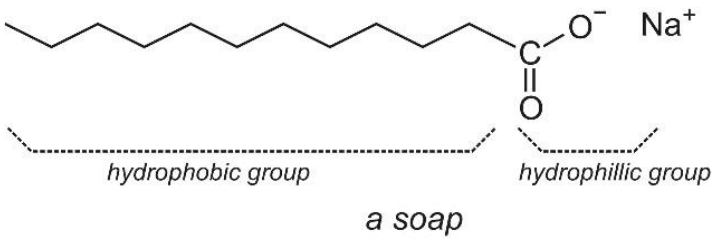


Figure 3: Typical chemical structure of soap/amphiphile consisting of two parts.

A surfactant's hydrophilic part can be negatively charged (anionic), positively charged (cationic), have both positive and negative charges (amphoteric or zwitterion), or have no charge at all (non-ionic). [7 – 10] as shown in figure 4.

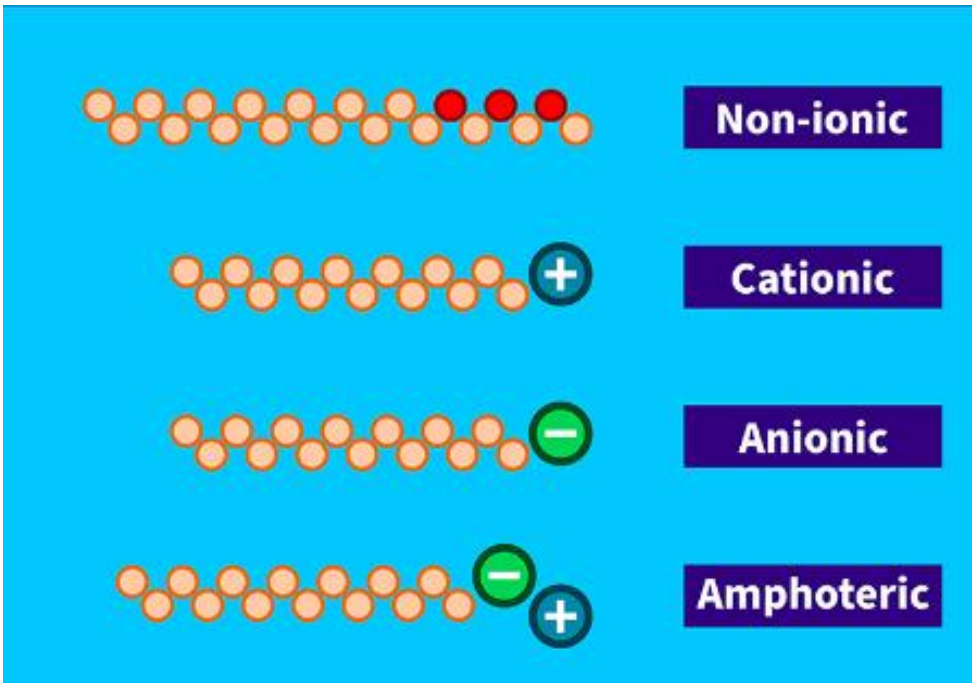


Figure 4: Various types of surfactants

An essential property of the amphiphilic molecule is that monomers in solutions tend to form aggregates, called micelles[10].

This micelle has the unusual ability to trap dust, oil, bacteria, and viruses. Figure 5 depicts the typical structure of the conversion from monomer to micelle. Critical micelle concentration (CMC) is the concentration at which micelles begin to form. It

was suggested by Adam[11] and Hartley[12] that micelles are spherical in shape.

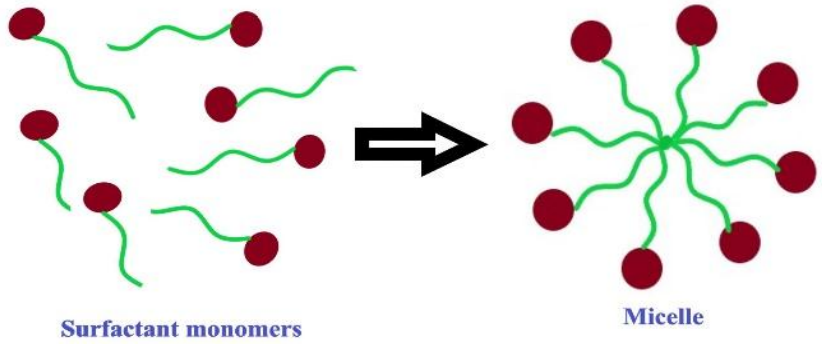


Figure 5: Surfactant monomer self-aggregate to form micelle

ACTION OF AMPHIPHILIC ON CORONAVIRUS

Soap/amphiphile is made up of two-sided molecules. One side is attracted to water; the other side is attracted to fat/oil/dirt/virus etc. Similarly, coronavirus is made up of material surrounded by a coating of lipids and proteins. Lipids are composed of oils and fats biological molecules. Even the membrane of coronavirus is generally composed of lipid particles. Hence they are attached together through chemical interaction. The hydrophobic part (tail) of the soap has the ability to react/interact with lipid molecules and then split them. When coronavirus interacts with soap molecules, that fat coating gets torn out by the soap molecules. The hydrophilic part (head) of the soap plays a vital role by allowing aggregates (micelle) to be drained out with water. Hence, soap literally annihilates coronavirus.

The structure showing the action of the amphiphilic molecule with coronavirus is represented in figure 6.

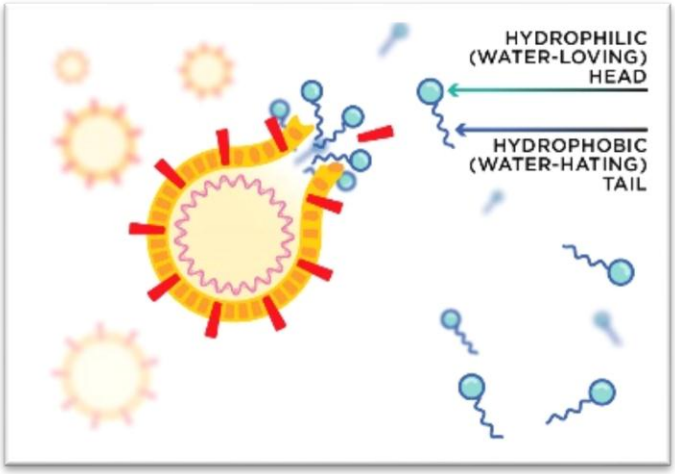


Figure 6: Amphiphilic molecules breaking lipid molecules

(Source: Jonatahan Corum and Ferris Jabr/The New York Times)

The typical chemical interaction between amphiphilic molecule and coronavirus can be represented in figure 7.

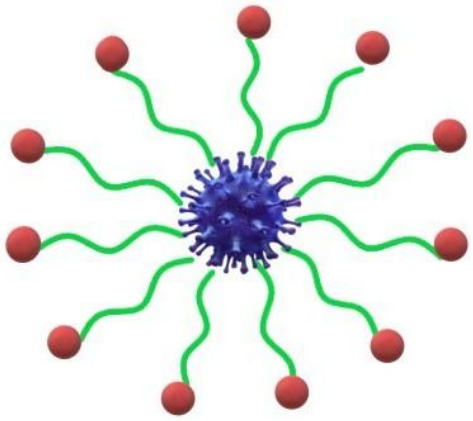


Figure 7: Micelle entrapped coronavirus

The fat membrane can be easily dissolved by soap/amphiphilic. Due to interaction, coronavirus either ditched or may dies or simply become inactive. Eventually, this coronavirus is to remain active for a longer time (hrs. days) exterior part of the body. Amphiphilic moiety provides interactions between the skin layer and coronavirus and finally, the virus is removed and falls apart like a house of cards due to the strong combined action of the amphiphiles and water. Simply water alone is not powerful to wipe out coronavirus just like it doesn't remove germs/bacteria/ from the body. The rubbing of hands together with soap and water and then drying them afterward is a great help in eliminating coronavirus particles from the skin/body part. The thing that one has to keep in mind is that washing hands frequently and for a specific duration (at least 20 seconds), will help to fight coronavirus. Hence no one hesitates to say that the amphiphilic is powerful in the current scenario to annihilate the coronavirus.

CONCLUSIONS

1) COVID-19 spreads from person to person via droplets of saliva or discharge from the nose or mouth when an infected person coughs or sneezes or passed via touch, direct hand-to-hand contact.
2) Coronavirus only gets entry into the respiratory system via mouth, nose, or eyes. A 2015 study found that people touch their faces an average of 23 times an hour.
3) Both water molecules and viral components can interact with soap molecules. The easiest way to get rid of any potential coronavirus on your hands before it can infect you is with soap and water.
4) These amphiphilic molecules trap tiny fragments of the coronavirus, which are washed away in the water. Soap literally annihilates viruses.

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