

Chemistry: soaps, detergents, food, and drugs

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Soaps and detergents are widely used in the society in order to achieve effective cleaning. More specifically, soaps are chemicals derived from fats and oils through a number of steps starting with the chemical treatment of fats and oils with a strong alkali such as sodium hydroxide.

Basically, the soap-making process can be summarized as; Fat + 3NaOH glycerine + 3 soap. Conventionally, the soap-making process takes place in four principal steps, including, but not limited to saponification, glycerine removal, soap purification and finishing. In saponification, a mixture of animal fat (tallow) and coconut oil is heated together with sodium hydroxide to make soap and other products such as glycerine. Subsequently, the glycerine part is removed in the second step, but some of it is left in the soap mixture to ensure its softness and smoothness. In this step, salt water is added to the mixture with the purpose of causing the separation of soap from glycerine, because soap is not soluble in salt. In the third step, a weak acid is added to the soap in order to ensure that all the remaining sodium hydroxide is neutralized.

Moreover, about two thirds of water is removed from the soap. The soap-making process is finalized by adding preservatives, color and perfume to the soap mixture and shaping it accordingly (Jones, 2005). On the other hand, detergents resemble soaps in structure and function, but they are derived from a synthetic surfactant, rather than a sodium or potassium fatty acid salt. Detergents include both powder and liquid products, which are sold as fabric conditioners, dish washing liquids and laundry powders. The process of manufacturing powder detergents is conducted in three principal steps, including slurry making, spray drying and post dosing (Jones, 2005).

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In slurry making, different ingredients, such as sodium tripolyphosphate (STP), sodium sulphate, soap noodles, zeolite and sodium carboxymethyl cellulose, are added into the slurry mixer and heated to about 85°C. The mixture is then stirred to produce a homogenous slurry, which is subsequently converted into finely divided droplets through deaeration in a vacuum chamber, followed by separation in an atomizer. The droplets are then spray dried at 425°C in a column of air to produce the base powder. Finally, other ingredients, such as soda ash, bleach, enzymes, color and perfume, are added to the powder, before the air is blown into the mixture in order to make a homogenous powder. Other ancillary processes in the detergent manufacturing process include soap removal, salt removal and glycerine purification (Jones, 2005). As stated earlier, soaps and detergents are widely used to achieve effective cleaning.

Therefore, in the process of cleaning, chemicals known as surfactants are added to water to reduce surface tension and allow water to spread and wet surfaces. Moreover, surfactants achieve a number of functions, including cleaning, loosening, emulsifying and suspending soil, so that it can be washed away. Surfactants also provide the required alkalinity to enable the removal of acidic dirt from surfaces. Generally, surfactants can be categorized into ionic, nonionic, cationic and amphoteric classes.

Accordingly, soaps are classified as anionic surfactants due to their negative charge in water. On the other hand, detergents include a mixture of anionic and nonionic surfactants (Jones, 2005).

The essential advantage of soaps is that they contribute vastly towards effective cleaning in different domestic and industrial activities.

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Unfortunately, the effectiveness of soaps in cleaning is affected by hard water, because the mineral salts in hard water react with soap to create an insoluble film, which remains as dirt on the cleaned surfaces. As a result, a lot of soap is required to achieve effective cleaning with hard water.

Conversely, detergents have many advantages over soaps, because they can achieve effective cleaning in hard water, particularly since the chemicals in detergents do not react with the mineral salts in hard water. Moreover, detergents are made from synthetic materials, implying that they consume fewer resources from the natural environment as opposed to soaps, which are manufactured from vegetable oils and fatty acids.

However, the dust and volatile products produced during the detergent manufacturing process pose potential environmental problems to human beings and animals (Jones, 2005). Pain Relievers Pain relievers are drugs used to reduce or provide relieve from different types of pains, including headaches, sore muscles and arthritis. Currently, there are many different types of pain relievers, but the most common and effective pain medicines include hydromorphone and fentanyl. Hydromorphone or dihydromorphinone is commonly sold as Palladone, Dilaudid, Dilaudid HP, or Exalgo. It is a potent opioid analgesic that is used to treat chronic pains, reduce moderate to severe pain, and in the treatment of painful dry coughs. It is a hydrogenated ketone of morphine, which is mostly administered intravenously (IV) to relieve pain.

Therefore, since hydromorphone is similar to morphine, it acts by binding to opioid receptors in the central nervous system (CNS) with the purpose of reducing both the perception of pain and the emotional response to pain.

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However, as opposed to morphine, hydromorphone is estimated to be 6-8 times more effective than morphine, besides being more soluble and, hence, it acts considerably fast. Moreover, hydromorphone shows less harmful side effects and a lower risk of dependency, when compared to other pain relievers (American Cancer Association, 2012). On the other hand, fentanyl is another effective opioid analgesic sold as Actiq, Duragesic, and Sublimaze. It is similar to morphine and hydromorphone in terms of treating severe pain and in the management of pain after surgery or pain resulting from a gunshot wound, but it is less effective than hydromorphone in the management of different kinds of pain. In some cases, fentanyl is prescribed for use in the treatment of chronic pain, especially for patients who are physically tolerant to different types of opiates.

As in the case of hydromorphone, Fentanyl acts by binding to opioid receptors in the central nervous system. In the process, it provides pain relieve by reducing the perception of pain and the emotional response to pain. However, as opposed to hydromorphone, fentanyl is administered transdermally, and it is gradually absorbed through the skin over a period of three days (American Cancer Association, 2012). Hence, considering the onset time, the severity of side-effects and the risk of dependency, it is apparent that hydromorphone can be preferred to fentanyl, because it possesses superior qualities in terms of treating a wide range of pain conditions and causing less troublesome side-effects. Vitamins and Minerals
Vitamins and minerals are required in the body with the purpose of enabling it to perform its functions properly by boosting the immune system,

enhancing growth and development, and helping body organs and cells to function properly.

Some of the vital vitamins and minerals include folate and calcium. Folate is a naturally occurring B vitamin, which is soluble in water. It is widely available through different types of foods including leafy green vegetables, e. g. turnip and spinach greens; fruits, e.

g. citrus fruits and juices; and beans, peas, and other types of natural foods. Folate is highly significant in terms of a diet, and that is the reason why the Food and Drug Administration recommends that different types of foods, such as breads, cereals, pastas, corn meals and flours, should be fortified with this vitamin (Jones, 2005). More specifically, folate is significant to the diet, because it is needed to prevent anemia during pregnancy. Moreover, folate helps in the production and maintenance of new cells in the body.

Folate is also needed in the synthesis of DNA and RNA, which are the basic building blocks of cells. Despite its widespread availability in natural foods, folate deficiency can occur when there is an increased need, especially during pregnancy or when there is malabsorption (Jones, 2005). Therefore, folate should be supplemented in diets in order to eliminate its deficiencies. On the other hand, calcium is a naturally occurring mineral in many foods including milk, cheese, kale, broccoli, fish, most grains and fine vegetable sources of calcium. This mineral is essential to the body, because it is needed in the maintenance of strong, healthy bones and teeth. In fact, it is estimated that almost all the calcium in the body is stored in bones and teeth, whereby it is used to maintain their structure and hardness.

Calcium is also needed in the body to support muscle movement and enable nerves to function properly. Moreover, calcium helps blood vessels to transport blood throughout the body. In addition, calcium is needed to help body organs in releasing hormones and enzymes, which perform different vital functions in the body. Unfortunately, calcium deficiency can occur when the intake of calcium falls below the required levels over the long-term. This can cause serious health consequences, including low bone mass (osteopenia) and an increased risk of bone fractures (Jones, 2005). Under such circumstances, it is recommended that calcium is supplemented in the diet through different types of foods such as breakfast cereals, fruit juices, soy, and rice beverages.

Carbohydrates, Proteins, and Fats Every person's diet requires the four principal nutrients, which include water, carbohydrates, proteins and fats. These nutrients perform a wide range of functions in the body, besides supplying the required energy. For instance, carbohydrates provide the energy required by the body in order to function properly. Moreover, different types of carbohydrates, notably, fibers are required in the body to help in the prevention of constipation, hemorrhoids and gastrointestinal problems. In addition, fibers are essential, because they lower the level of blood cholesterol and reduce the risks of heart disease and colon cancer. On the other hand, proteins are essential food compounds, required for growth and development.

Proteins supply the energy for the body, in addition to providing the raw materials needed in the production of hormones, enzymes, muscle tissues and antibodies. Moreover, proteins provide the required acid-alkali balance

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in the body. Further, the body needs essential fatty acids to carry out vital functions, which include transporting fat-soluble vitamins in the body, growth and development, and maintenance of healthy body organs such as the skin, hair, and nails. Furthermore, essential fatty acids support other food components, such as proteins and carbohydrates, in supplying the required energy in the body (Jones, 2005). In order for these food compounds to perform the aforementioned functions, they should be supplied in the required proportions, because their insufficient or excessive amount can cause different problems in the body. For instance, too many carbohydrates can lead to an upsurge in total calories resulting in obesity.

On the other hand, too little carbohydrates can lead to lack of energy (malnutrition) and excessive breakdown of fats and proteins to make up for the missing calories. Further, the side effects of too many proteins include weight gain, intestinal irritation, dehydration, seizures and an increase in liver enzymes. On the contrary, inadequate protein intake causes vomiting, diarrhea, lack of appetite and stunted growth. In the case of fats, the redundant body fat increases the risk of type 2 diabetes, high blood pressure, heart disease and different types of cancers. On the other hand, deficiency of essential fatty acids in the body causes retarded growth, impaired absorption of fat-soluble vitamins and disorders of the skin, hair, and nails (Jones, 2005).