

# Applications of Petrochemicals: A Mini Review



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## Abstract

Growth and advancement in the field of petrochemicals is still a key concern to industrial economy at global level. Petrochemicals have vast variety of industrial applications in detergents, cosmetics, food industry, agriculture, dyes etc. The present summarizes the application areas of petrochemicals.

**Keywords:** Petrochemicals; Plastics; Dyes; Preservatives

## Introduction

Petrochemicals are a very complex industrial sector that influenced almost every sphere of life. In everyday life, use of plastics, soaps confirms the importance of petrochemicals in our daily world. The petrochemical industry links downstream sectors like pharmaceuticals with the upstream oil and gas industries. The petrochemical industry renovates feed stocks such as naphtha and natural gas components like ethane, propane and butane through steam cracking or catalytic cracking into petrochemical building blocks i.e. olefins and aromatics.

Petrochemicals are chemical derivatives from petroleum. Several chemicals made from petroleum are also acquire from other fossil fuels like coal or natural gas, or renewable sources like corn or sugar cane. Two major petrochemical classes are olefins (include ethylene and propylene) and aromatics (i.e. benzene, toluene and xylene isomers). Oil refineries manufacture olefins and aromatics through fluid catalytic cracking of petroleum fractions.

Petrochemicals may be classified into three main categories: Light Petrochemicals like methane, ethane and ethylene (gas at room temperature), petroleum ether and light naphtha (liquid with boiling points in the range of 80 and 190 degrees Fahrenheit; Medium Petrochemicals: this fraction consists of 6-12 carbon atoms and known as "gasoline", which are principally used as automobile fuels i.e. Octane is a particularly good automobile fuel with high quality; Heavy Petrochemicals: Diesel oil, heating oil and lubricating oil are the examples of heavy petrochemicals, generally exploited in engines and machinery.

Main application of petrochemical is their exploitation as a fuel. The combustion of crude oil gave in-road to origin of numerous energies from petroleum. Petroleum has been a source of energy for lighting, heating and locomotion and predominantly the most expedient fuel for the internal combustion engine. This use has amplified promptly in significance with the coming of the motor car and a vast range of other applications of internal combustion engine [1]. Beside their use in transportation, petroleum has been used as a key source in the synthesis of organic compounds. By 1965, approximately more than 80% of the world organic chemicals were created using petroleum. This figure increased up to 98% in 1980 and finally up to 99% at the end of the year 2000. Thus, petroleum chemicals (petrochemicals) are a vast range of chemicals. Industrially significant ones comprise gasoline and kerosine. Petroleum jelly is a greasy gelatinous substance obtained from petroleum and exploited as ointment base, lubricant and protective covering [2].

In addition to that, Petrochemicals are playing very significant role in various other industrial area. Industrial raw materials obtained or synthesized from petrochemicals are wax, fertilizers, preservatives, soaps and detergents, dyes, plastic commodities, plasters, sports shoes and explosives: most of the explosives contain petroleum products. In spite of an immense degree of progress and advancement petrochemicals are still a key concern to global industrial sector. Present article covers the major industrial applications areas of petrochemicals.

Wax is a by-product of petroleum, which is used to making candles and molds [3]. Disclosed the method of preparation of

high wax emulsion and investigated the affecting factors on preparation. In this study, wax emulsions were synthesized using paraffin wax as a chief material using emulsifier-in-oil method. The effects of the type and quantity of the emulsifier, the temperature and time of emulsification, and speed of stirring and quantity of emulsifying water, on the emulsification has also been investigated. The experimental result revealed that compound emulsifier was better than sole emulsifier. The optimum reaction conditions required for best quality wax were emulsifying water 65%~70%, emulsifier 10%, emulsification temperature 90°C, emulsification time 30min stir speed 1000r/min. The wax content in the paraffin wax emulsion obtained under optimum conditions reached 30%~35% and showed excellent stability and dispersive property.

Jiang & Yan [4] gave the preparation of high wax content emulsion in which they synthesized cream colored paraffin wax emulsion with wax content more than 50% with excellent stability, good fluidity and dispersivity. Investigators also claimed this emulsion as environment-friendly with high wax content emulsion.

Lu Ya [5] revealed the synthesis of modified paraffin wax through air oxidation and the effect of reaction time and reaction temperature on the properties of modified paraffin wax were studied. The results reflected that when synthesis was carried out at reaction temperature in between 155-160 °C for the reaction duration of 56h, the properties of modified paraffin wax obtained were found similar to natural beeswax. Synthetic wax was claimed to be a good substitute of natural beeswax.

Detergent, a petrochemical product is also used in everyday life. It has been categorized into 2 types – soap less variety and the soapy variety. The range of soap less detergents is generally powdery or liquids. or in the form of gels. Detergents have been synthesized using oils, alcohol (a petrochemical product) or petrochemicals as their raw materials.

Haupt DE, Schwin PB in late 70s [6] paper attempted to address in their article about the complex question of petrochemical raw materials' and their future role for their supply to the soap and detergent industry. The following points were accentuated:

- a) The basic reserve oil and natural gas, although not in infinite quantities as in the past, would be accessible in the future.
- b) The petrochemical industry would continue to receive its essential share of the offered petroleum resources, and the detergent industry would continue to obtain the feedstocks they necessitate.
- c) The cost pressures which would be impacting the surfactant producers would be the same to the overall rise in the rates affecting the entire economy.

In a study done by Condon and Matheson in [7] a comparison of surfactants derived from alcohols based on petrochemical and oleo chemical sources have been made. Some samples of C<sub>12</sub> type alcohols derived from palm coconut oil, kernel oil and ethylene (Ziegler) were plagiaristic into alcohol sulfates and alcohol ether sulfates. Physical and performance properties for every surfactant were estimated both as individual as well as in light-duty liquid (LDL) dish-washing formulations. The slight differences has been observed in the physical and performance characteristics of the surfactants and their formulations were claimed to be assignable for slight differences occur in between the individual alcohol, alcohol sulfate and alcohol ether sulfate samples investigated in this study. In this investigation, it has been concluded that alcohol sulfates, alcohol ether sulfates and LDLs formulated from them exhibit almost similar physical and performance properties regardless of whether the original alcohol was developed from petrochemical or oleo chemical sources.

Preservatives are another important type of petrochemicals that are used in cosmetics and Food-additives. Preservatives increase the tenure of freshness of cosmetics and canned food in order to maintain their freshness. Petrochemical also springs itself to the manufacture of Vitamins i.e. the ASA (Acety salicylic acid). Vary (1990) disclosed a method for preparing vitamins using petrochemical waste from corn syrup as well as from waste of meat industry using *B. megaterium*. This microbe was claimed to have ability to exploit a large number of carbon sources.

Hayama et al. [8] Disclosed a hair cosmetic composition comprised of a graft copolymer or an alternating block copolymer, each of which consists of a first unit containing a polysiloxane group and a second unit encompassing a polymer of unsaturated monomers. Both the units were linked via sulfide linkage. The hair cosmetic composition affords hair with softness, combing smoothness, luster, enhanced volume, styling ease, and has good hairstyle retain ability and damage-restoring features. Solieri & Giudici [9] disclosed article vinegars of the world. In this article he also discussed the history of vinegar production. Vinegar may be produced from almost any fermentable carbohydrate source by a two-step fermentation process that involves yeasts as the first agent, followed by acetic acid bacteria. And can be also used as food preservative in pickles.

Sneakers (synthetic shoes) have also got petroleum products as their content. The rubber soles are made in the way as that can retain the same flexibility in every type of climatic conditions unlike natural rubber that expands when cooled and contracts when heated [10]. Revealed in his article that nylon can be used in making sneakers. The non-stick pads made in order to plaster wounds are also a type of petrochemical product. Nowadays, the medical industry has improved its standards by leaps and bounds and petrochemicals have been served as a bonus to this sector.

Gaglio et al. [11] invented a viscous fluid dispensing apparatus by applying viscous fluid to a surface. It was flexible backing material of a closed-cell material and a flexible dispensing material of an open-celled material disposed over and carried through the flexible backing material. The open-celled material has an internal structural spacing sized relative to the viscosity of the fluid so as to absorb and allow the fluid to slowly pass there through. Preferably, the flexible backing material along with the flexible dispensing material was sealed together about the periphery thereof to form a hollow pocket. The fluid in the form of a salve, gel, or the like, and was disposed in the hollow pocket. The pocket can be filled with an oxidizing agent and exploited for tooth whitening and/or gum dealing. The pocket may be attached to an adhesive backing in order to create adhesive bandages which apply numerous medications to the underlying skin area. This approach can be employed for treating wounds and blemishes. The pockets can also be used for dispensing a variety of other materials including makeup remover, moisturizer, cleansers and polishes.

Dyes are very familiar petrochemical products of having various colors particularly the color of the ink used in the pens [12]. Introduced a printing reactive dye stock thickener based on polypropylene acid sodium Alginate. This new printing gum comprised of natural as well as chemical gum along with optimum proportion and rational emulsifying technique. The new gum remains the characteristics of sodium alginate. It also exhibited the better structural viscosity, alkali stability, permeability and so on. The practices specified that high apparent colour yield and excellent printing effect were achieved through applying the new gum. It was considered to be a perfect paste for reactive printing owing to the printed fabrics with clear outline and smooth lines.

Ethylene is a byproduct achieved by heating or distilling the oil is one of the most essential constituent of petrochemical oil which is used to make garbage bags, camera films, milk crates, bags etc. In an comprehensive discussion Sundaram et al. [13] discussed the production and uses of ethylene, the topics also encompasses the properties of ethylene, industrial production, shipping, handling, storage, and economics. Extensive attention of the industrial production via thermal cracking was detailed. Ethylene makes the largest volume building block for many petrochemicals. Ethylene is a colorless gas with a mild odor which is not irritating to the eyes or respiratory system, and hence also considered as a mild asphyxiant. Plastic bottles are also made up from petrochemicals. Polyester is used to make most plastic commodities. In addition, compact discs and cassettes are also made up of polyester or petrochemical oil.

Blundell & Osborn [14] described the morphology and related properties of the aromatic thermoplastic poly (aryl-ether-ether-ketone) (PEEK)  $[C_6H_4-O-C_6H_4-O-C_6H_4-CO]_n$ . Topics covered include crystallization and melting behaviour,

crystallinity, spherulitic structure and lamellar thickness. PEEK was closely analogous to poly (ethylene terephthalate) in its crystallization behaviour excluding that the main transitions occur at about 75 °C higher [15,16].

### Conclusion

The petrochemicals of commercial importance in the petrochemical industry and are the building blocks that can be further processed to yield final products great applicability and their economic importance towards our society cannot be ignored.

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