New Development in the Chemistry of Fire- Fighting Foams

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ABSTRACT

Fire-fighting foams function by several different mechanisms as shown in fig.1. In recent years there has been numerous attempts to modify or replace the traditional high performing fluorinated types of foaming agents (such as perfluorooctyl sulphate, PFOS which is used in pool fires) with new less hazardous foaming chemicals.

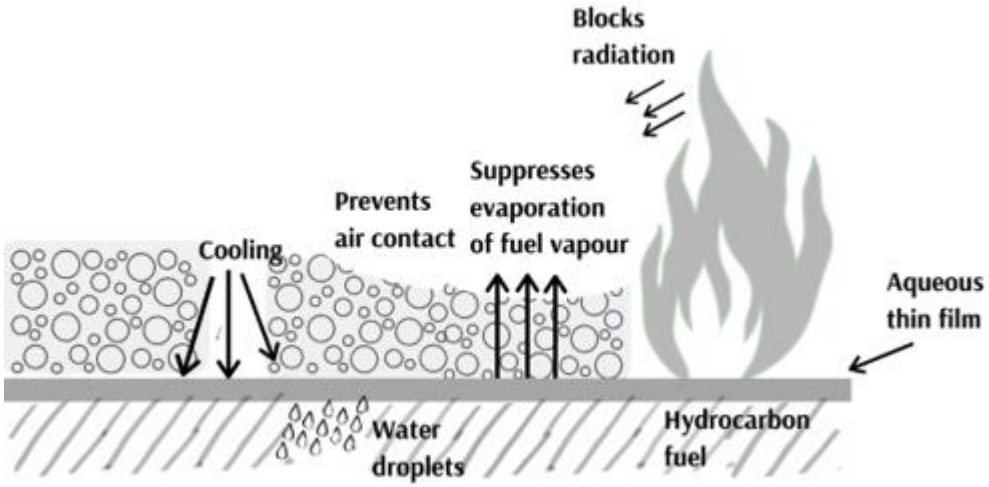

Fig 1: Function of fire-fighting foams

One approach was to use shorter chain length molecules such as fluorotelomers of perfluorobutane sulfonate but these shorter chain length precursers have been found also to cause F build-up in the environment so this is not a realistic solution to the problem. Other possible alternative to the fluorinated surfactants are siloxane surfactants and some of these newly developed types exhibit positive properties with regard to fire extinguishing but are not persistent or bio-accumlative [1].
Some hydrocarbons blends have also been considered as candidates as foaming agents such as xanthate gums, aliphatic alcohols, sulfosuccinates, poly-ethers. Recent studies involve research into synergistic effects in mixtures of 2 or 3 different hydrocarbon surfactant types to give improved surface activity and heat stability. Some progress has been carried out at Bristol University where the synergistic effects of mixtures of sodium lauryl sulphate with low amounts of fluorinated surfactants [2]. Another system which showed synergism consists of alkyl polyglycosides with sodium decyl sulphate where foam expansion was used to optimize the surfactant ratio [3].

New fluoro free foams were introduced in 2010 by Orchidee International in France introduced and advertised as the highest performing fluoro free foam and are today marketed as a Blue foam. Another

possible more environmentally friendly group of foaming surfactants may be the early hydrolysed protein produced from cattle hooves and horns protein systems used in the 1920 and 30 ´s. Potential candidates are the synthetic polymeric protein surfactants. Unfortunately, mixtures of proteins consist of complex molecular structure and have yet to be synthesised. In addition, there are numerous other types of low surface tension producing protein, polysaccharides, glucosides which need to be well defined and pure.

Particle stabilized foams are also of interest and hollow glass microspheres and and fly ash and mud have been used in coal mining fires and more recent developments involve the introduction of small bio-inert silica particles silica system which is based on a sol-gel foam system [4]. This foam is produced by mixing acetic acid with a mixture of aqueous based surfactant (SDS) with sodium silicate. The resulting self-hardening silica-based sol gel foams consisted of organized silica particles with a narrow particle size distribution (10-20 nm). In this paper we discuss some of the replacements for polyfluorinated chemicals.

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