The foam concentrate is a mixture of different raw materials such as solvents, salts, corrosion inhibitors and mainly surfactants. In case of synthetic products, there are two types of surfactants: hydrocarbon chain, which are primarily responsible of foaming capacity and foam stabilization, and fluorinated, in which part of the hydrogen chain atoms are replaced by fluorine atoms. The fluorinated surfactants are the key component in AFFF agents because they bring to foams repellence and resistance to hydrocarbons. They add also the ability to form an aqueous film of only a few microns on hydrocarbons.

1. Environmental Regulations

Fluorinated surfactants can be manufactured by two processes, electro fluorination or telomerization. By using the first process, which is not longer used, it is generated products derived from PFOS (perfluorooctyl sulfonate), whose use in Europe is limited to proportions smaller than 0.005% by weight of finished products, according to European Directive 2006/122/EC. In the case of fluorinated surfactants produced by telomerization process, there is no specific regulation and are currently used as raw materials for AFFF agents manufacturing. Therefore, it is important to clarify that not all AFFF products are banned, but only those made with a specific type of fluorinated components.

Other fluorinated product which is subject to a special control by environmental authorities is PFOA (perfluorooctanoic acid). Although PFOA is not prohibited, nor it is a raw material to be used directly in foam manufacturing, there is a risk that the degradation of some fluorinated products generates this acid. The voluntary program from EPA “2010/2015 PFOA Stewardship Program,” in which are involved the leading manufacturers of fluorinated products, aims to reduce fluorinated surfactants with chains of 8 atoms or more atoms mainly to chains of 6 carbon atoms (C6) before 2015. This way, it can be assured that any component degradation will not generate PFOA, since PFOA is a product with an organic chain of 8 carbons (C8).

During the last year, some proposals about regulation of PFOA levels has been proposed by different government; still not a clear desition since there is a lot of discrepancies about the achievable level that “makes happy” all the parties involved.

Apart from these international prohibitions and regulations, some countries are restricting also the use of any organohalogen components if they are likely to arrive ultimately to open waters, forcing many facilities to look for alternative solutions to AFFF agents, mainly in products without fluorine, which affects the performance considerably.

2. Fuels

Nowadays there is a growing amount of polar additives used in the composition of gasoline. The hydrocarbons can be extinguished with certain foams by violent application but polar solvents dissolve the foam when applied directly over the fuel. The mixture of hydrocarbons and polar liquids is an issue that should be considered by users because depending on the type and quality of foam the foam application techniques may be different.

Ethanol has been in recent times a fuel which demand has grown strongly, both for direct use or as an additive in gasoline. Nowadays the size of storage tanks containing this fuel is increasing. Ethanol must be treated as a polar liquid at the time of designing the fire fighting installation. The problem being when increasing the size of the tanks is to extinguish with portable systems (monitors), normally when there is a failure in the fixed fire fighting installation (frequent situation in case of explosion) since the direct application on the fuel is not possible.

The LNG (Liquefied Natural Gas) is another fuel that has gained importance in recent years, with large tonnages of LNG stored and transported by sea worldwide. Until now, protection of bunds of LNG is performed using high expansion systems, although some recent trials suggest that low expansion systems can be as effective with high performance foams.

3. Foam Concentrates

Due to the many changes in regulations, raw materials and fuels, the manufactures of foam concentrates have developed or modified their products to adapt them both legally and operationally to the market demands.

Both the new AFFF agents, whose fluorinated surfactants are mainly C6, and the foams known as Fluorine Free (3F) have been lately the innovations and main lines of development for several manufacturers. The development of more concentrated products is also a trend in the market, in which products of 1% are very common in the petrochemical industry, far from the traditional 6%. Currently, there are on the market AFFF and AR-AFFF that can be dosed at 0.5%. The logistic advantages of these type of products in the case of large foam demands are evident with respect to traditional 3% and 6%.

Another trend is the increasing market demand for synthetic-based products (AFFF and AR-AFFF) compared to traditional protein (FP, FFFP and FFFP-AR). The best firefighting performance, better burn back resistance along with no-degradation over time are the key

to success.

Fluorine Free foams have increased their popularity because of environmental restrictions in some countries. The foams without fluorinated components have existed for many years in the market (protein, multi expansion foams, Class A forest retardants, etc..) although it is also true that in the last decade synthetic fluorine products have been developed for Fire Fighting Class B, with the goal of being valid alternative to AFFF agents, but with less environmental impact. Until the appearance of this new generation of products without fluor, the forceful application of foams was only effective if AFFF products were used. However, some new Fluorine Free are also able to be used directly on hydrocarbons, although its behaviour and efficiency is still far from AFFF performance, especially when it is used with non-aspirating nozzles.

Despite of the significant progress reached in the development of this product range, still have some limitations and AFFF or FFFP foams are still not ready to be replaced without serious evaluation. Before replacing an AFFF or FFFP by a Fluorine Free foam, it is necessary to check if the new solution have the same certifications and ratings than the existing product. It is highly recommended to carry out a comparative fire testing with both products, evaluating the effectiveness of both in different applications, with the available resources in each case (proportioning, nozzles, etc..) and avoiding a simple “paper” comparison based on the documentation of the products.

Electronic proportioning systems and CAFs allow to use highly concentrated products.

4. Fire-fighting systems

The traditional proportioning systems are based on mechanical principles, designed for fixed working conditions (flow, pressures, etc.). This is the case of Venturi type inductors, membrane tanks, systems around the pump, etc. In addition to its low flexibility in terms of flow rates and proportion rates, they are not particularly precise in the proportioning. For this reason it is not recommended to use with high concentrated foam concentrates (less than 1%), where small error in the injected amount of product can represent a significant error in the proportion rate, which can generate consequences in efficiency, autonomy and economy.

Although foam concentrates (0.1-1%) have been traditionally used in Class A fires (solids), new developments have also allowed the use of AFFF and AR-AFFF products with at very low dosage rates (0.5%). In order to use these products with accuracy in the proportioning, it is strongly recommended the use of electronically controlled proportioning systems. A flowmeter is installed in the water line and this information is sent to a control unit, which controls the foam injection system, accurately adjusting the amount of foam required for each water flow. These equipment are very common in fire trucks, but can also be used in forest systems, fixed installations, etc.

Another important development in the sector has been the development and implementation of Compressed Air Foam Systems (CAFS), which are based on the injection of compressed air into the foam solution (water + foam), producing foam with uniform fine bubbles and excellent adhesion and cooling capacity. Since the foam is produced by the injection of compressed air is not necessary any restriction for the air intake at the nozzle, resulting in a large range with excellent foam quality. Better drainage times, faster extinctions, better burn back resistance, less water consumption, etc. are some of the characteristics of CAF systems.

Do we have to renew our stock of foam concentrate?

From the point of view of a user that has foam concentrates stored in his warehouse, it can be raised the question if it is convenient to renew his stock of foam in view of the many changes previously discussed. To carry out this evaluation it is necessary to ask the following questions:

Are we sure that our AFFF product is not formulated with PFOS?

If our stock of AFFF product is previous to 2000, it is necessary to ensure that it does not contain PFOS by carrying out a specific analysis of the fluorine compounds contained.

Does our product keep its characteristics and properties? ¿Have we done any analysis of the product since the purchase?

Some foam concentrates experience a reduction on its effectiveness over time. It is recommended to verify periodically the quality of the product.

Is our product certified according to standard EN-1568:2008 with the required classification?

The standard EN-1568-3:2008 is the reference standard in Europe and we must know the classification of our product both with hydrocarbons (EN-1568-3:2008) and with polar liquids (EN-1568-4:2008). Depending on the classification of the product, we must evaluate if our firefighting equipment is suitable to be used with the existing foam concentrate.

Does our product comply with other standards that can be important for our risks?

If the foam concentrate is going to be used for fires in storage tanks, airports, etc. where there are specific regulations, it is recommended to confirm the compliance with these regulations by carrying out the corresponding tests.

Is the proportion rate the most adequate for our interests?

The foam concentrates has progressed towards a reduction in the proportion rate, from the traditional products 6% to most modern ones 0.5%. In some cases the foam concentrates have only a single proportioning rate for hydrocarbons and polar solvents (1%, 3% and 6%), but in other cases the proportioning rate change depending on the fuel (0.5×1, 1×3 and 3×6). If it is necessary to protect both against hydrocarbon and polar solvents fires, the most convenient option is to have a product with one only dosage rate to avoid mistakes during firefighting operations and especially in the case of a fire brigade whose type of emergencies are very different.

Is our product effective with all the fuels and risks we have to attend?

Most of the standards use heptane as reference fuel for hydrocarbons fires, and acetone and isopropyl alcohol for polar liquids fires. Moreover, they generally use aspirating nozzles (excepting standard UL-162). Thus, it is possible to compare the effectiveness of different products in constant conditions. It is likely that the real fires are with other fuels such as diesel oil, gasoline, kerosene, ethanol, methanol, etc. or even a mixture of these fuels, hence we must be sure that our foam concentrate is capable of extinguishing and protect effectively against all types of fuel with the firefighting equipment available.

Is it suitable our foam concentrate to be used with our firefighting equipment?

We must know what is the real performance of our foam concentrate when operates together with our firefighting equipment. Firstly, we must verify that the proportioning system is suitable to be used with our foam concentrate, and especially if the product is pseudoplastic such as AFFF-AR or Fluorine Free products, due to their high viscosity at low

temperatures. It is also important to know the foaming capacity of our foam generators (low, medium or high expansion).

For more information, go to www.auxquimia.com