SAFETY BULLETIN

RestorixHealth®
Excellence in Wound Care

Hair and HBO_2

Synthetic Hair | Hair Products | Facial Hair

A RestorixHealth Safety Bulletin

Depending on the type of synthetics used, synthetic hair can be extremely flammable and SHOULD NOT be used in the hyperbaric environment. If for some reason it is required, an exception form should be submitted for the clinical team to review.

Synthetic Hair

Synthetic hair is made from a very fine plastic filament that closely resembles natural hair strands. It can be made from a variety of different types of synthetic materials – some of which are extremely flammable. In this case, the term flammable is associated with the materials flash point, and should not be confused with combustible, which is different parameter. Flammable products, of which there are several classes, have a lower flash point and therefore can be ignited (vapors) at lower temperatures.

SYNTHETIC HAIR TYPES

Mono-fiber

Mono-fiber grade A+ is relatively new class of synthetic hair not yet widely used. It is the highest quality synthetic hair on the market today, with the realistic look and feel of human hair. Mono-fiber hair material has a PET (polyethylene terephthalate) composition, which is a thermoplastic polymer resin of the polyester family. Since PET does not contain polyethylene, mono-fiber grade A+ synthetic hair is heat resistant.

Kanekalon

Kanekalon is a type of modacrylic fiber made of PVC composition filament. It has a shiny, polished or “fake” look. Kanekalon was one of the first synthetic hair materials on the market. It is widely used in many hair accessories and is very inexpensive. Kanekalon is highly flammable and can release dangerous chemicals into the smoke as it burns.

Futura

Futura is a newer type of synthetic hair that closely resembles human hair. This synthetic is very durable and can even outlast human hair. Like human hair, it can be heat processed to either straighten or curl it. Futura can withstand heat up to 400 degrees F.

Hair Products

Hair products are sold as gels, pump sprays and aerosols. Aerosols present an even more complicated and dangerous situation because the propellant gas is delivered along with the product and becomes part of the matrix.

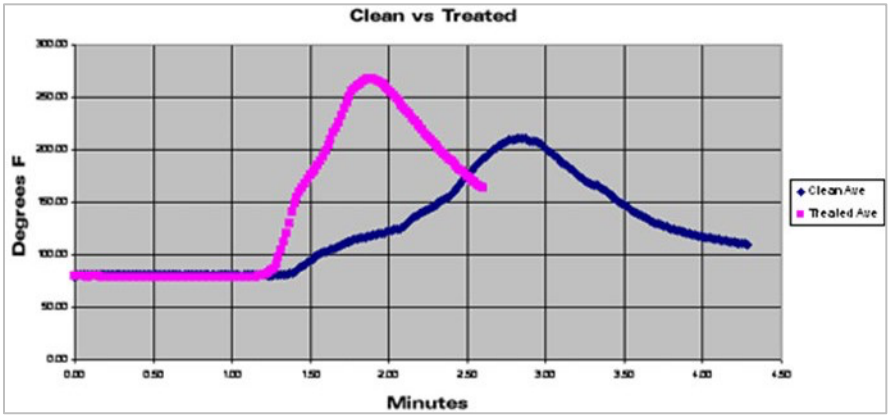
Aerosols are classified according to the product and the propellant. This classification is numerical, i.e., Class 1– 2 – 3, depending on the stability of the propellant, which is based on water miscibility. A complete definition and explanation can be found in NFPA 30B.

Once the carrying solvent of a hairspray evaporates, what is typically left behind is a light coating of an organic polymer dispersed throughout the hair. It is this organic solid residue that holds the hair together and is in fact the material for which the hairspray was purchased. Hairspray without this solid organic residue would be pretty much useless as a hairspray.

Oxygen can accumulate in low lying areas and can saturate clothing and hair – including beards – because it is heavier than air. Oxygen reacts with most materials. The higher the oxygen concentration and pressure in the atmosphere or in an oxygen system then:

- combustion reaction or fire will be more vigorous.
- ignition temperature and the ignition energy to promote the combustion reaction is much lower; and
- temperature of the flame is higher and consequently the destructive capability of the flame is greater.

Almost without fail, the organic solid residue of a hairspray is flammable (capable of burning with a flame). The fact that hair fires deal with solid hair and solid residue often leads to underestimating the flammability of the combination. One might think of the combination of hair plus hairspray residue as “combustible” because they are both solids. However, no heat is needed to ignite the mixture. This is due to the high surface-to-volume ratio of the hair plus hairspray residue.



Clean vs treated hair temperature versus time of clean hair and treated hair

Aerosol Hairspray Burn Example

A woman had sprayed her with a hair spray product consisting mostly of mineral oils. The instructions on the container were to leave the product on the hair (soak) for 30 minutes. After about 25 minutes, she lit a cigarette and her hair burst into flames.

Facial Hair

Moustaches and other facial hair can act as kindling for nasal oxygen tubes when a spark joins the mix, even if the spark is just a tiny ember. Avoiding a potential spark in the first place is paramount, such as not smoking for a minimum of 15 minutes post enriched oxygen exposure.

If your culture and religion allow it, shaving facial hair would be the main preventative measure in eliminating the risk of facial burns.

Hyperbaric Example

A hyperbaric patient with hair product in hair or beard is not screened properly and undergoes HBOT. At the end of treatment, the patient walks out of the clinic and once outside lights up a cigarette. The oxygen level in the hair or beard is still elevated and the potential for a possible oxygen fire is increased ten-fold. Persons who have been exposed to an oxygen-enriched atmosphere should not smoke or go near open flames, hot spots or sparks until they have properly ventilated their clothes in a normal atmosphere. A ventilation period of not less than 15 minutes with movement of the arms and legs and with outerwear removed is recommended.

Many accidental fires and burn injuries have been initiated by the lighting of a cigarette; it is therefore

imperative to emphasize the danger of smoking in oxygen enriched atmospheres or where oxygen enrichment can occur. In such areas, smoking shall be prohibited.

Oxygen Enrichment Incidents Examples

1. A patient was smoking a cigarette whilst receiving oxygen therapy through a nasal cannula and oxygen from an oxygen concentrator in his home. The cigarette caused an ignition of the nasal cannula and subsequent burning of the plastic caused small scale scalding of the upper respiratory tract. The patient was seen by a medical practitioner and returned home soon afterwards. Contact with the patient led to an admission that he had been smoking against warnings, instructions and training.
2. A patient was using an oxygen concentrator at home. Patient's daughter reported that her mother had lit a cigarette and the cannula and tubing ignited, burning her nose. Cannula had adhered to her nose. Patient taken to hospital via ambulance.
3. Hyperbaric patient lit a cigar in parking lot post HBOT and received facial burns from their oxygen enriched beard that caught on fire. Patient was taken to the emergency room for burn treatment
4. A person who was wearing proper clothing was working in an oxygen-enriched atmosphere. He went to a smoking area and immediately lit a cigarette, whereupon his clothing ignited.

   A major factor involved was the presence of facial hair such as moustaches and beards. NASA had already investigated the fact that human hair ignites more readily in the presence of higher oxygen concentrations, but no-one had previously looked into this within the context of oxygen therapy. To test their theory, they used mannequins exposed to enriched oxygen environment for 45 minutes. Once removed from the enriched oxygen environment they exposed them to a spark. Those mannequins with a moustache and beard ignited, whereas those without facial hair did not.

What Hyperbaric Providers and Technicians Need to Know

When clearing any product for hyperbaric you MUST know the following information...

- **Autoignition Temperature:** The lowest temperature required to ignite or cause self-sustained combustion in the presence of air and in the absence of a flame or spark.
- **Flammable Range:** The range of concentration in volume percent of flammable gas or vapor between the upper and lower flammability limits.
- **Lower Flammability Limit:** The minimum fuel mixture in volume percent with air through which a flame will just propagate.
- **Upper Flammability Limit:** The maximum fuel mixture in volume percent with air at which a flame will just propagate
- Limiting Oxygen Concentration: The minimum oxygen concentration in volume percent (at a given temperature) in a gaseous mixture containing a fuel below, which a flame will not propagate.

Medical devices and products are changing daily, and we MUST be proactive to ensure the safest environment possible for the patient and our healthcare staff.