Threats and security measures used in the process of creating cosmetic products

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Abstract

The work has analysed the issues of work safety in the cosmetic industry, which has been developing in recent years mainly due to the increasing demand for hygiene aspects, beauty and healthy living. Potential hazards arising from work in the production hall and individual machines, as well as dangers arising from contact with chemicals in the form of raw materials or semi-products, and their transport and storage, are presented. There are descriptions of major hazardous materials, outlines of machine operations and hazards associated with their use, and ways to protect workers on particular production lines. Attention has been paid to the characteristic of cosmetics production, due to positive associations intuitively but wrongly, perceived as safe, which is additionally associated (confused) with the food, chemical or pharmaceutical industry. Examples of industry branches are provided based on the most hazardous to the health and life directions of cosmetics production, and include ideas for enhancing the safety and functionality of the production line.

Keywords: Production of Cosmetics, Dangers, Main assumptions of work

1. Description of production

Production facility consists of major departments.

Transport department, responsible for importing and exporting all goods (raw materials, final products) and maintenance of long and internal transport vehicles.

Production and maintenance department responsible for the manufacture of cosmetics and maintenance of production lines including both machines and work environment. This department is most widely described.

Chemical department responsible for laboratories, all raw materials used at the production line and security solutions.

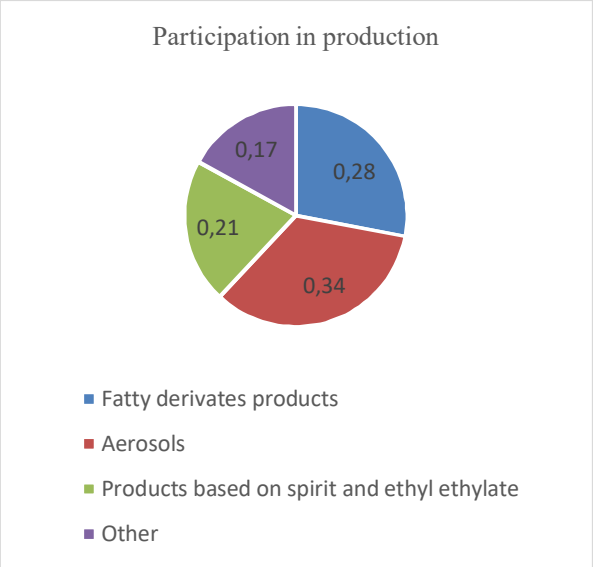
Warehouse department responsible for storing and transporting finished goods, raw materials and semi- products to individual production lines, thus combining all branches of production.

And marketing department omitted in this work.

The main production lines are:

• Production line of “creams”, Fatty derivates products (mixers, filling machines, dangerous raw materials)
• Aerosol production line (gas injection and filling chambers, gas delivery line, Propane-Butane tanks)
• Production line of spirits and washers (pouring machines, ATEX Security systems)
• Line of product packaging (packing lines, sealing machines)

Based on sales data, was created diagram that shows share of the individual lines in general production, and consequently, the contact of workers with the hazards of the production line.



From the diagram, it can be inferred that the largest part of the production line are those with the most threats and requires appropriate equipment, machines and security systems.

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2. Fatty derivates products

As examples of this product was chosen shaving cream, due to the complicated process of creation and the raw materials used.

General process:

1. Preparation of raw materials according to the product card,
2. Dosing raw materials into the mixer,
3. Oil phase – heating,
4. Water phase – heating,
5. Saponification process,
6. Automatic temperature control,
7. Adding active ingredients,
8. Cooling,
9. Homogenization.

The process takes place in mixer, pressure melting tank and cooling chamber. For safety purposes, Weighing machine equipped with extraction is used in measuring dry materials.

2.1. Dangerous materials

Basic materials such as perfume and refining components, propylene glycol, glycerol, silicones and stabilizers.

There are, among others worth the attention:

2.1.1. KOH

Potassium hydroxide KOH. It is a corrosive substance, causing severe burns, harmful effects, negative effects when ingested.

Can cause severe eye damage (corneal opacities), respiratory roads and skin, causing tissue necrosis.

2.1.1. NaOH

Sodium hydroxide NaOH. It is a corrosive product that causes chemical burns. Can cause severe burns skin, respiratory tract and mucous membranes.

Already 2-3% solution cause severe swelling. Skin, softening and epi-dermal necrosis.

Wounds after contact with this com-pound heal very slowly, and cause severe painful wounds. Even the smallest amount can cause loss of sight.

Do not store with ammonium salts and their alloys, especially in the form of powders.

Due to the formation of ammonia, the poisonous gas forming an explosive mixture with the air.

The formation of ammonia by the action of the base on ammonium salts.

$$2NH4 + + NaOH - \rightarrow 2NH3 \uparrow + H2O + NaH$$

Formula (1) Reaction of ammonium salts with a strong base

2.2. Safety measures

If material gets into eyes, for example by rubbing with hands, the hygiene sector is equipped with an eye washer so that the worker can get rid of the substance from the body as soon as possible. During work, it is possible for an employee to overrun with a corrosive agent or to light a garment on an employee, in that case, no more than 20 meters in the horizontal line from the workstation where the working processes take place, are installed are sprayers. In addition, employees must wear protective clothing, reinforced shoes, safety glasses, headgear, trousers and aprons, resistant to chemicals, protective gloves.

3. Products based on spirit and ethyl ethylate

The main hazards during the production of products based on spirit and ethyl ethylate are vapors of 2-ethyl acetate, acetone and contaminated spirits. Vapors are irritating and highly explosive, therefore the area of production of washers, together with the spirit where the liquid settings are made, are keept in a separate rooms of specially prepared building.
Production of detergents along with the production of aerosols are one of the most dangerous cosmetics creation processes, due to the risk of explosion, and intoxication.

3.1. Explosion hazard and ATEX

3.1.1. Fire classification & Tank for contaminated spiritus

Table 1. *Physicochemical classification.*

Composition	Flash-point [C°]	Boiling point [C°]	Relative density	Self-ignition [C°]	Group and temperature class
96,6% C_2H_5OH	13	3,1	79	363	II A T2

The 30,000dm^3 spirit tank is located in a separate room in which for production purposes, 96.6% of ethyl alcohol is kept.
When working with a spirit, the risk may be due to leakage of contents from the tank. To limit the spillage of spiri, the tank was placed in a specific "tub", calculated to accommodate the volume of the tank. The second safe measure is held at the universal container sorbent, dustless and non-abrasive granulate in a hydrophilic version.

Ethanol is highly flammable and forms explosive mixtures with air. Vapors are heavier than air and accumulate near the surface.

3.1.2. ATEX

All equipment in the hall where spirits are produced and where there is a danger of explosion by the concentration of vapors in the air, must comply with the Union Directive European ATEX (from Fr. Atmosphères Explosibles), so any product or device that has been approved by the manufacturer must have an Ex designation. This is a scientifically proven lack of ability to spark or heat up a particular device or object during its duty.

The most important element of safety during the production of alcohol based cosmetics is ventilation. A specially designed installation for purifying air from vapors extends over the whole spirit. The entire installation, and in particular the fans, must be marked EX so that the vapors do not explode as a result of contact with the ventilation elements. Ventilation reduces the risk of worker poisoning and vapors. When the safe level of vapors are exceeded, the alarm system is activated and all possible ventilation routes are opened.

3.1.3. ATEX components

As mentioned earlier, all items must be crated in EX system. This includes, but is not limited to:
Rompox 1107 ESD anti-static floor,
ES-SYSTEM Cosmo2 lighting fixtures,
Pumps for installation, barrel and mixer pumps,
Pallet trucks from up to the explosion zone.

A specialist safety clothing is very important in the safety of workers.
Contact with raw materials used in spirits is very harmful to health, so the basis is the equipment to protect the respiratory system of the employee, and eye protection.
During operation, be equipped with gas mask A and particle filter P2. Protective gloves, ethanol-resistant and safety goggles in a sealed enclosure.

4. Areosols

The most commonly used aerosol can filling gas is propane butane. As it is a highly explosive gas, safety must be ensured both when filling the tanks at the plant site and during product development, as well as ensuring the safety of the user.

Hazardous gas components are C_4H_{10} butane and C_3H_8 propane. Extremely flammable gas. Forms explosive mixtures with air. In the gas phase heavier.

From the air may lie in the hollows to use. At high concentrations it is suffocating, narcotic and slightly irritating as a result of displacement. Oxygen from the surrounding air. Direct contact with liquefied gas can cause frostbite.

4.1. Issues of confection

First the spirit is poured into the tin, then the can is closed with a valve on the jam device called cripmper.

Another is the gasification appliance introducing gas through the mounted valve on the container.
The pouring and gasifying section of the line is located in a separate room from the rest of the hall.
The automatic rotary pouring module is protected by ventilation and vapor (2% permissible volume in air) in explosion-proof technology.
The unit container, when approaching the filling head, pushes the limit switch to actuate the dispensing of liquid product. Pouring is done by volume, which excludes the ability to overflow in the event of a failure.

The whole filling process takes place in a glazed enclosure, where the extracted vapors are removed by the ventilation duct. Opening the door from the room for more than 20 seconds automatically switches off the entire line and switches on the extra fans.

4.2. Pneumatic Line

Aerosol line filling machines, due to the reduction of sparks and higher temperatures, are pneumatically driven by compressed air and EX-series electric motors. The safety of work and the viability of pneumatic systems in the hall depends on the preparation of compressed air. Contamination such as scale, rust, dust as well as airborne liquid components can cause major damage to the equipment and lead directly to a failure in which the worker may suffer. Damage is mainly caused by abrasion of smooth surfaces and sealing elements.

ISO 8573-1 standards must be met

Table 2. *ISO 8573-1 Quality of compressed air.*

Compressed air class	Maximum size of solids [µm]	Maximum concentration of solids [mg/m^3]	Water Dew point [C^o]	Oil concentration [mg/m^3]
1	0,1	0,1	-70	0,01
2	1	1	-40	0,1
3	5	5	-20	1
4	15	8	+3	5
5	40	10	+7	25
6	-	-	+10	-

5. Risk assessment

Directive 96/82 / EU defines the risk as a probability of harmful effects over a specified period of time or in specific situations.

The process of analysing risk and determining its level of acceptability is called risk assessment.
The risk analysis consists of:

- Description of the system, including the characteristics of the application of the installation, raw materials ,, products
- Identification of threats by identifying potential causes of peak events that determine the impact of hazardous substances and their effects
- Definition of risk, as the product of the probability of effects and exposures of peak events (accidents) and scenario development events
- Determination of risk tolerance (acceptance), application of appropriate measures to limit it

Once the risk is identified, the worker should be informed of the magnitude of the risk at the workplace with particular regard to:

- Hazardous agents present at the workplace showing how to prevent them from working
- The effects of harmful and cumbersome factors, including the results of studies and measurements of these factors,
- Apply the necessary collective and individual protection in the presence of hazards at a given post
- Necessary preventive measures, given the particular grave risk that should be introduced, to reduce the level to an acceptable level
- Measures that are used in the future will reduce the level of serious and medium to small or negligible risk

5.1. Classic Risk Score method

The risk in the method is determined by the formula:

$$R = P * S * E$$

Formula (2) Calculation of risk numerical values

R - risk
P- probability of occurrence of threat
S - potential effects of the threat
E - exposure to danger

As a result of calculating the product of R, a numerical value corresponding to the risk category and the requirements of preventive actions is obtained.
The following describes how to determine the value of individual factors P, S, E and determine the risk category.

Probability (P) of the occurrence of the threat:

- Highly probable - 10
- Quite possible - 6
- Unlikely, but possible - 3
- Only occasionally possible - 1
- Possible to think - 0.5
- Practically impossible - 0.2
- Only theoretically possible - 0.1

Potential effects, sequelae (S):

- Serious catastrophe, many fatalities -100
- Catastrophe, several fatalities - 40
- Very large, fatal victim - 15
- Large, severe injuries - 7
- Average, employee absenteeism - 3
- Little, at most first aid - 1

Exposure to Hazard:

- Constant - 10
- Frequent (daily) - 6
- Sporadic (once a week) - 3
- Occasional (once a month) - 2
- Minimum (several times a year) - 1
- A little (once a year) - 0.5

The risk category resulting from the above relationship is defined as:

Table 3. *Categories of risk, and appropriate actions.*

Category 1	Very High Risk	$R \geq 400$	**Consider stopping work**
Category 2	High Risk	$200 \leq R \leq 400$	Needed immediate improvement
Category 3	Average risk	$70 \leq R \leq 200$	Need improvement
Category 4	Low Risk	$20 \leq R \leq 70$	Need attention
Category 5	Negligible risk	$R \geq R < 20$	No action are needed

Category [1], [2], [3] are acceptable occupational risk. As a result of risk analysis, risks are identified that are acceptable and do not require any preventive or preventive action. In other cases, the scope and timing of preventive actions should be established.

The employer is obliged to re-evaluate the occupational risk posed by the chemical agent if:

- Change in composition of chemical agent
- Change in technological process
- The advancement of medical knowledge about the impact of this factor on human health.

6. Concluding information

This work aims to provide extention for knowledge of safety, with specific examples from another area of industry, which in the last several years is growing rapidly mainly due to the increasing public demand for luxury goods, and at the final conclusion specify a number of proposed solutions for increasing safety of workers, among others:

- Look for alternatives to hazardous materials.
- Application installation, which would be collected hazardous materials from the warehouse without weighing them by employees.
- The use of overhead cranes instead handcart
- The use of impactors on the corners of the shelves.
- The use of non-slip floor surface.
- The use of two smaller containers to leak a large amount of alcohol in the case of failure.
- The use of other gas. The use of valves with aluminum bags.
- Mute aerosols filling chambers.
- Compliance with the requirement not blocking transport routes.
- The use of an electronic system for the organization of the warehouse, Comarh XL
- Changing packer model with movable foil.
- The examples are only a few most common machines and products,

To ensure safe workflow, employee of EHS must get acquainted with potential dangers of working with individual machines, as well as those resulting from contact with chemicals.

Added to this is also the safety associated with the storage of individual raw materials or finished products, and safe work on the production floor. For more hazardous materials used as a permanent base to create specific cosmetics are methylated spirits, commpressed propan butan or highly concentrated alkali. The threat can arise from both the toxicity, irritation, the possibility of explosion and the temperature at which the material is used.

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