

INTERNSHIP REPORT

FOAMS INDIA BED PRODUCTS



TRAINING PERIOD (10/11/2023-24/11/2023)

SUBMITTED BY:

VICTORIA LAKRA

Reg no: 42910026

MSc Chemistry (final year)

BATCH (2022-2024)

DEPARTMENT OF CHEMISTRY





FOAMS INDIA[®] BED PRODUCTS

25, PADMAVATHI NAGAR, MADURAVADU, THIRUVARCADU,
CHENNAI - 77. PHONE : 26801880
www.foamsindia.com
AN ISO 9001 - 2008 Company

10.12.2023

Date

CERTIFICATE OF INTERNSHIP

This is to certify that Victoria lakra (42910026) . II Msc
(Chemistry), Student from department of Chemistry, Sathyabama University
600119 has successfully completed 14 days Internship Training on
"Manufacturing and processing of Natural Latex Foam" conducted from
10th November 2023 to 24th November 2023

During this period we found her very sincere, Hardworking and punctual also
having good understanding of the subject matter.

For Foams India Bed Products




Suganthi M | Human Resources





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WHOMEVER IT MAY BE CONCERN

We would like to give the feedback regarding internship of the following student during the above mentioned period of work in our factory

Student Name : Victoria lakra

Department No : 42910026

Internship Report	Lab Analysis	Workplace Performance	Total
10	18	6	34

For Foams India Bed Products,


Keerthana J.J | Supply Chain Manager



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Industry profile



FOAMS INDIA BED PRODUCTS is 100% natural latex foam manufacturing company situated in Thiruverdkadu, Chennai. They are one of the leading producers of Rubber foam Mattresses, Pillows, Cushions and Slabs confirming to comfort, Safety and Durability.

The products are anti - allergic and keep you warm in the winter and cool in the summer.

Independent tests prove that their latex foam is three time more resistant to dust, mites and bacteria than ordinary mattress. Foam mattress can last up to 20 years and No problem of sagging and no inconvenience. It conforms to the contours of the body creating a cushion and no pressure point are caused during rest.

INTRODUCTION:

History of Latex

Natural rubber originates from the rubber tree, *Hevea brasiliensis*. During his second journey to Central America in 1493, the explorer Christopher Columbus was the first European to come across rubber. The Maya, who had been living in the Amazon region for centuries, had long been extracting the white sap from these slender trees, which can grow up to thirty metres tall. At the time of Columbus, they were using it to make balls and toys.

The name Rubber

A major breakthrough occurred in 1770, when chemist Joseph Priestley noticed that lines drawn with a pencil can be removed using rubber. That is how the name 'rubber' – derived from the English verb 'to rub out' – came to be used.

The background of rubber

In 1839, Charles Goodyear discovered that the properties of rubber can be greatly improved by heating it with a small percentage of sulphur. This process is called vulcanisation. When rubber is vulcanised, it retains its elasticity but becomes stronger and less sticky.

Vulcanised rubber could be reinforced even further by adding other materials such as soot. Goodyear had discovered the process of vulcanisation by accident when a mixture of rubber and sulphur happened to land on the stove in his workshop and he noticed the result. Following his discovery, rubber trees were planted on a large scale in countries all over the tropics, such as India, Ceylon and Indonesia.

Thanks to these plantations, rubber products became available worldwide. Goodyear applied for a patent for his discovery in June 1844.

Extraction of the white sap

The milky sap of *Hevea brasiliensis* is extracted by making a groove through the bark into the cambium layer. The veins of latex are cut through so

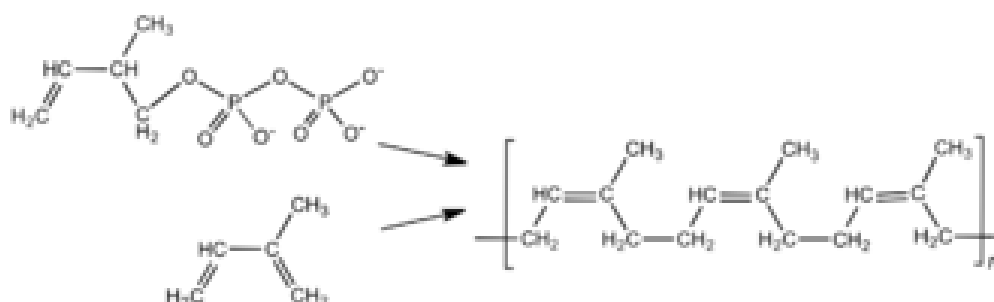
that the sap flows out. Collection trays are suspended under each groove so that the milky white sap can be collected.

About 30% of the collected sap consists of rubber. A number of steps need to be taken to extract the rubber from the sap. The latex must first be filtered and diluted with water, after which the mixture is treated with acid so that the rubber particles coagulate.

The coagulated rubber is then rolled into thin slices in a drum. At this point, the rubber still contains too much protein; these proteins may start to rot and must therefore be removed.

The sheets are smoked in a dedicated chamber to remove the proteins, leaving brown, smoked sheets. These are stacked into bales and transported to rubber mixing mills.

STRUCTURE



Latex is the polymer cis-1,4-polyisoprene – with a molecular weight of 100,000 to 1,000,000 daltons. Typically, a small percentage (up to 5% of dry mass) of other materials, such as proteins, fatty acids, resins, and inorganic materials (salts) are found in natural rubber.

Polyisoprene can also be created synthetically, producing what is sometimes referred to as "synthetic natural rubber", but the synthetic and natural routes are distinct.

Some natural rubber sources, such as gutta-percha, are composed of trans-1,4-polyisoprene, a structural isomer that has similar properties. Natural rubber is an elastomer and a thermoplastic.

Cultivation of latex

Latex is a milky-white liquid sap that comes from the rubber tree. It consists of rubber particles, water and little contents of resins, sugar and ash. Due to its high elasticity.

it is used to make rubber and other related products such as shoes, balloons, gloves, mattresses and many more. In fact, latex is one of the best natural materials to make mattresses because of its intrinsic characteristics: elastic, anti-dust mite and mould resistant.

Natural latex is extracted from the Hevea Brasiliensis rubber tree as mentioned above and requires precise skill when harvesting latex from the tree barks.

A worker cuts a strip of the bark halfway around the tree, about 0.84cm deep allowing the latex to exude into a collecting vessel for some hours about six hours. Large amount of organic latex is required to make a single mattress, for a king size.

It would take at least a whole day's output of 12 acres of rubber trees. Important to note that harvesting the sap does not harm the tree. After the sap is collected, the tree bark heals quickly.

The trees can yield latex milk for up to 25 to 30 years. After that, the trees are felled to be used for other purposes such as furniture and new trees can be replanted.

Executive summary

As this is all about the latex foam production ,There are certain fundamental steps in the production of latex foam rubber,

- (1) The foaming of the compounded latex by the introduction of air or other latex.
- (2) The gelling of foamed latex in a suitable mould to give a sheet material.
- (3) The vulcanization process of the rubber .

Basically there are two types of methods for the production of latex foam such as Dunlop and Talalay . Foams india employ Dunlop method.

The DUNLOP method

If pure natural latex is used, the latex “milk” is mixed with the required chemicals. Once matured, the compound is foamed up with a mechanical mixer (SBR-latex can be foamed up without maturing) and filled into metal molds. A gelling agent is added to the mixture, to generate a fast reaction that stabilizes the foam structure. The molds are then placed in a steam oven or tunnel to vulcanize the cores. Since foamed products are good thermal insulators, the molds are fitted with a large number of pins to transfer the heat into the foam itself. Once vulcanized, the pillow or mattress core is stripped, washed, dried and is finally ready for sale.

The several operations involved in this method of making latex foam is as follows,

- De ammonization of latex
- latex compounding
- Mixing

- Moulding
- Vulcanization
- Washing and drying

The Talalay method

The Talalay process is a bit more involved. It was developed in the 1940s and has been tweaked over the decades. Here is the modern process,

- Liquid latex extract is mechanically whipped to form a frothy foam
- The foam is injected into a mold; however, the mold is filled only partially
- The filled mold is vacuum-sealed, which causes the latex to expand
- The filled mold is then frozen rapidly, pushing carbon dioxide through the latex
- The frozen material is baked to set
- The latex is removed from the mold, washed, and dried

The Talalay process is designed to produce softer, fluffier latex with a more homogenous consistency. The resulting foam is softer and much less dense, which makes it well-suited for comfort layers, but not ideal for support cores.

Differences Between Dunlop and Talalay Latex in Mattresses

The main difference between these two foams is that Dunlop is firmer and more dense, while Talalay is softer, less dense and more homogenous in nature. When it comes to mattresses, here are the most noticeable differences between Talalay and Dunlop

Durability

Dunlop is generally considered to be more durable than Talalay latex. This is due to the much higher density of Dunlop. With that said, both versions are exceptionally durable when compared to most other mattress materials.

Cost

Dunlop is generally less expensive to manufacture, mostly because the process is far less intensive. This can often be reflected in the final price of new mattresses, although the difference in price-points is generally small.

Feel

Generally speaking, Dunlop latex is firmer and more dense than Talalay latex. Often, this means that Dunlop is used for the support core in latex mattresses, while Talalay is reserved for top comfort layers. However, both versions can be engineered to a variety of firmness levels.

Temperature Neutrality

Talay latex is generally more breathable than Dunlop latex, as it is less dense, and allows for better airflow. This results in Talalay offering slightly better temperature neutrality in most circumstances.

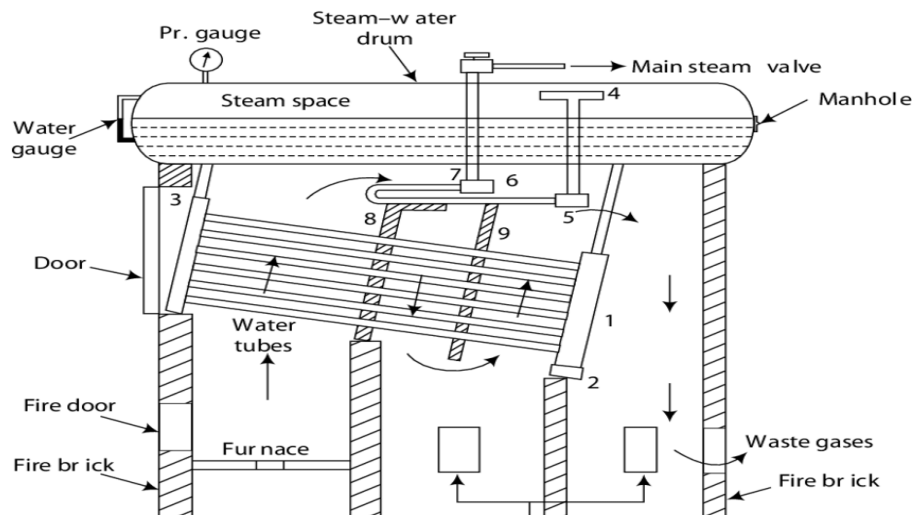
Environmental Sustainability

Latex in general, regardless of the manufacturing process, is considered to be more sustainable than alternatives such as memory foam. It's naturally derived from a sustainable source, and it's more durable than alternatives, offering a lower environmental cost in the long run.

The Dunlop process is slightly less energy-intensive, so it may be somewhat more sustainable than Talalay.

Both manufacturing processes can produce high-quality, durable, and comfortable latex. Ultimately, the overall quality of the mattress and the reputation of the manufacturer are typically more important than whether the bed utilizes Talalay or Dunlop latex.

Boiler operations



Water tube boilers pass water through the tubes, which are then heated externally by hot gas from the furnace flue gas. The heated water rises into a steam drum, where it can then be reheated by a superheater to achieve even higher steam temperatures - this superheated steam is a dry gas most commonly used to drive turbine engines used in thermal power stations.

As we know one of the latest advances in steam production technology is the use of water tube boilers .

This type of boiler is distinct from conventional boilers that use a fire tube system. Water tube boilers are more efficient than fire tube boilers ,generating more steam but using less fuel and they are much safer than fire tube boilers and easier to manage when it comes to routine inspections an maintenance.

I believe using a water tube boiler for this manufacturing process it's a brilliant idea as its overall efficiency with an economizer is up to 90% and it occupies less space moreover it happens to be very low maintenance costs.

MANUFACTURING PROCESS

(1) Preparation of latex compound :

Natural rubber latex is used for foam productions. The compounding is done in two stages. The gelling process is dependent on pH reduction and its desirable therefore that the ammonium concentration of the latex is adjusted to a controlled level, usually 0.2-0.25%

When a high ammonia natural latex is used, it is necessary to reduce the ammonia to this level prior to compound preparation. This is achieved by stirring the latex with an air stream over the surface. During this process, a small amount (0.25-0.5%) of potassium oleate can advantageously be added to minimize any risk of destabilization.

Deammoniated latex is compounded by adding Sulphur, ZDC, ZMBT and antioxidant dispersions are allowed to mature for 24 hours.

Followed by this to the matured latex compound, the ingredients are added as per the second stage compounding during the course of the foaming operations. Zinc Oxide, DPG and sodium silico fluoride dispersions need not be added at this stage.

(2) Foaming process :

Potassium oleate is first added in to the latex compound and is weighed into the bowl of a planetary mixer with the whip rotating at a very high speed so as to expand the foam and raise it to the required height as rapidly as possible. As the density of the finished product depends directly on the foam density and therefore the foam height it is measured accurately.

After attainment of the required height, the whip speed is reduced to comminute the bubbles and refine the foam without further reducing the density and the filler paste is added just before the required volume is reached. It is basically required accordingly.

Zinc oxide and sodium silico fluoride are used as gelling agent and DPG is used as a secondary gelling agent. A measured amount of zinc oxide dispersion and DPG dispersion are added to the bowl and stirred in to the foam followed by a measured quantity of sodium silico fluoride dispersion after a further period of blending and the liquid sensitized foam is poured from the bowl into a mold.

Through mechanical agitation in the presence of air in the planetary mixer the foaming of the latex compound is achieved.

(3) Molding :

In the process the molds used are usually made from cast aluminum the lids containing the familiar domed cavity formers. This type of cast aluminum alloy molds combine the desired properties of good heat transfer ,resistance to corrosion ,lightness and smooth surface to facilitate stripping.

Each mold is conditioned to ensure that its temperature is uniform and constant, generally about 40- 50°C and treated with a mould release agent . There are many alternative mould release agent employed ,out of the most widely used are aqueous solutions of sodium carboxy methyl cellulose or medium molecular weight polyethylene glycols or a mixture of both.

To Ensure good demolding the Mold release solution should be applied evenly and uniformly.

According to the inches the moulds differs accordingly, if the mattress is about 3 inches multicore mould is applied and for two inches mattress pincore mould is applied .

(4) Foam gelling :

After settling the foam in to the mould and positioned the lid, a short interval allowed before the mould passes in to the curing chamber. During the interval, zinc oxide and sodium silico fluoride adding them bring about gelation of the foam.

The addition of gelling agent is adjusted so that gelation is complete in about 5-10 minutes. Control of the gelling reactions is vital for good foam production .Mould temperatures are usually controlled to 30-35°C for the pan and 40-45°C for the lids .

If something goes wrong about maintaining the mould temperatures can lead to defects which includes loose skin or thick skin on the surface of the product.

(5) Curing process :

The moulds pass in to a curing chamber where they are exposed to live steam at atmospheric pressure for 20 to 30 minutes the time duration is all depends on the thickness of the product.

As the thin sheet requires less time and the thick sheet requires more time after the process though the foam is not fully cured but it is strong enough to allow the lid to be automatically opened and the product is removed from the mould and the surface which is interior is sprayed with mould lubricant.

(6) Washing and drying process :

As the foam may contain number of water soluble non rubber constituents such as soap which could lead to poor ageing, bad odour and poor resilience so it is necessary to get this contaminants removed so the process shall go ahead with passing the moulding through a series of roller and water is sprayed simultaneously to clean it effectively and the containing water is removed by a squeeze rolling machine.

It is followed by the drying process in which the foam containing less moisture after coming through the squeeze roller the wet products are placed in an open mesh conveyer which passes through a chamber with hot air circulation.

The temperatures are generally between 100-110°C and the drying time is about 1 to 2 hours . The drying temperature should not exceed more than 110°C if it happens it might lead to charring of dry foam.

(7) Defects and Remedies :

If there happens to be a defect there should be a possible cause and the remedies which already kept as suggested for it, so in case of defects those remedies shall be applied.

If the defect happens to be like Coarse structure and rat holes the cause should be the gelation at a low pH so increasing pH secondary gelation agent shall help it .

when it is like loose skin due to the insufficient gelling agent or cold mould increasing gelling agent and using warm mould shall help as a good remedy

Flow marks or splitting in the centre due to gelation is too hot using cooler mould than before will help it

when it is foam collapse before gelation due to the poor foam stability increasing foam stabilization and gelling agent shall act as a remedy and help it.

Though there are possible cause and remedies for it is already been sorted out it is very rare or no chance of a defect as the whole Manufacturing process is monitored with great care.

Benefits of latex mattress

Natural latex beds are preferable to synthetic and blended latex for their eco-friendliness, durability, and health benefits.

1. Pain Relieving

The gentle cushioning and buoyant support of latex foam mattresses are especially beneficial for sleepers with back and joint pain.

Latex foam softly cradles heavy body parts, such as the hips and shoulders. This light contouring provides pressure relief near the joints and lower back, while latex's natural elasticity maintains natural spinal alignment by gently supporting lighter areas, like the neck and back.

2. Hypoallergenic and Low Maintenance

If a bed is not continually cleaned, microorganisms, such as bacteria, fungi, and viruses can easily collect on the top of the mattress and cause mold, mildew, and dust mites.

This results in bedroom allergies and an unsafe sleeping environment. However, latex is naturally antimicrobial, meaning it repels harmful microorganisms, making latex an excellent choice for people with year-round allergies or anyone too tight on time to sanitize their mattress.

3. Eco-friendly

As mentioned above, natural latex is refined from the sap of the rubber tree. The trees are not cut down or damaged during this process and can produce sap for up to 30 years.

Therefore, the processing of latex mattresses encourages tree growth and is extremely sustainable. Natural latex is also biodegradable, ensuring it won't sit in a landfill for years.

Although harvesting latex is a sustainable process, latex mattresses are not always manufactured responsibly. Some manufacturers use chemicals harmful to our health and environment.

A GREENGUARD Gold, OEKO-TEX Standard 100, eco-INSTITUT, or GOLS certification will guarantee the mattress is primarily composed of natural materials and safe for use. We will further discuss these certifications later.

4. Breathable

Natural latex foam has an open-cell structure to permit constant airflow. The foam layers are also constructed with pinholes, enhancing breathability. Most importantly, chemicals found in synthetic materials retain body heat and natural latex mattresses contain little to no additives.

If you want an especially cool mattress, opt for a breathable cover made from cotton or wool.

5. Durable

Natural latex mattresses are best known for their long-term comfort. High-quality latex mattresses have an average lifespan of 12 to 20 years—significantly longer than other types of mattresses. The resiliency of natural rubber is often credited for this longevity. A natural latex mattress effortlessly bounces back once the pressure is removed, maintaining its original shape over years of use.

QUALITY CONTROL OPERATIONS

The Compression Set test is conducted which involves compressing a test sample to half its original thickness for 22 hours at an elevated temperatures of 158°F and then allowing it to decompress.

The greater the loss of thickness, the more likely the material is to take an impression over time.

The Impact test is conducted its about the weight of 45 pounds is dropped repeatedly on the mattress core for 24 hours. The core is allowed to recover for 24 hours, then its firmness is measured again.

The greater the loss of firmness from the first measurement to the second indicates how likely the material is to break down over time.

It is necessary to check whether the final products are within the specifications and also incase of the needs for corrective actions is the manufacturing process.

TECHNOLOGICAL SUGESSTIONS

Instead of using a normal dryer making use of a radio frequency dryer in the manufacturing process shall help with the more production and also in a less time as it is high energy transfer efficiency, uniform heating within the product, reduced equipment dimension and better preservation of sensorial, chemical and physical characteristics of the product.

The major advantage is that it gives thorough, consistent drying in less time and also occupies less space.

In addition to these following advantages are prominent:

1. Faster Drying
2. Faster Production
3. Decreased Labor Production
4. Less work in progress
5. Energy Saving
6. Less Down Time
7. Lower Maintenance
8. Space savings

So I believe though it is way too expensive, but shall help with the production rate and the time as well.

Dry Rubber Content (DRC) TEST

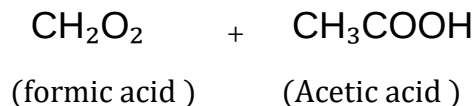
As we know Centrifuged latex is today available commercially in two different varieties with high ammonia (min. 0.7% of ammonia) and low ammonia (max. 0.3% of ammonia). ... High Ammonia (HA) -Foam products, dipped goods, adhesives, elastic thread, household and industrial gloves, balloons, rubber bands and finger caps.

It contains 60% Dry Rubber Content (DRC) It is a general purpose latex widely used in many latex applications mainly foams.

Separate the preserved field latex into two fractions , one containing the concentrated latex of more than 60% dry rubber content and the other containing 4-8% dry rubber in other words (skim latex)

Skim latex is generally coagulated with sulphuric acid , made in crepe, dried marketed as skim rubber ,which is basically low grade rubber.

It is calculated by taking 10ml of latex and adding up



$$\odot \quad W1 / W2 \times 100$$

→ W1- Weight of the wet of the latex

→ W2- Dry weight of the latex.

Ammonia content test

Ammonia is used to stabilize latex and prevent premature coagulation in rubber during transportation to the factory so it is necessary to check the ammonia content in order to pursue with the next steps of manufacturing.

Ammonia content test is followed by taking 10g of latex as a 4 batch from 100g of latex milk .

So it happens to be a four set of samples and the concordant value shall be observed.

The concentrated hydrochloric acid is taken as the burette solution with 0.1% Normality and the Indicator is methyl red solution with (0.1% alcohol) added as 6 drops to the 250ml beaker and the appearance of pale pink white is the end point of the titration

$$\odot 1. \quad 7 \times N \times V / W$$

→ N- Normality of hcl

→ V- Volume of the hcl

→ W- Weight of latex in grams.

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