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Industrialization of Rogan Paint

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Abstract: The goal of this study is industrialization of a traditional art and henceforth reducing the cost of finished product, so that it can be made available to common man as well. By taking into consideration the traditional procedure, Rogan paint has been prepared in this instance. Prior to using this information on an industrial scale, a few industrial instruments have been considered and information regarding their utilization has been provided, taking into consideration the actual work completed in the lab. On a pilot scale, it can be evaluated and then modified.

KEY WORDS: Rogan, Textile, Paint Industry, Indian Traditional Craft

1 Introduction

India is a multicultural nation whose traditions and history are still very much alive today. There are numerous traditional fabrics and works of art there. This offers an unusual and artistic assortment of goods. Indian artisans have a long history dating back to almost 5,000 years of specifically weaving, resisting, painting, and ageing textiles with prints. Throughout the course of art history, the most used technique for expression is Painting; it has a built-in appeal for aesthetics. That is superior to other forms of visual art. Many attribute it to being Chinese, although India and Egypt are more likely to claim to have had previous knowledge of the paintings and textiles with prints. The pieces of cotton that were madder-dyed textiles were discovered at the Indus Valley sovereignty of Mohenjo-Daro.

Warli Art, The wall paintings created by Warli, Kokana, Kathodi, Dhodi, and Malkhar kholi women make up the distinctive Warli art that is only found in the tribal areas of Thane and Nashik in Maharashtra. These tribes, which are mainly from Western India, are located in Mumbai's northern suburbs. In the early 1970s, this artwork was first noticed etched on the mud walls of nearby cottages. Instead of depicting themes from Indian epics, the Warli painting emphasizes contemporary socioeconomic issues. Chittara Art, In the Karnataka regions of Shimoga, Uttar Kannada, and Sagara, the Deewaru group has recognized and practiced the Chittara art form. The homes' walls are covered in red mud, then white artwork is added on top using rice paste and white mud. As with many ancient arts, the primary ingredients—tree bark, seeds, coal, rice flour, berries, to name a few—are all completely natural. The walls, door frames, window frames, and floors are painted with a special brush made of grass fiber and natural threads. Pata Chitra, The traditional art form known as Pata Chitra is practiced in many places, including West Bengal and Orissa. Bright color use defines the paintings in the Bengali art style known as Pata Chitra. The colors were made using a variety of natural materials, including spices, soot, earth, flowers, and more. To discourage people from participating in regressive social behaviors, the artwork represented those behaviors. The centuries-old art is linked to a time

when wandering minstrels sang about difficulties and life while they wandered the state. Gond Art, A traditional form of Indian art known as "Gond art" first appeared in the tribal areas of central India. The Gond people's natural surroundings served as inspiration for the paintings, which depict rivers, hills, streams, and woods. The Gond art, which is displayed on the walls, ceilings, and floors during rituals and celebrations, is impressive. Because they are created using a series of dots and dashes that are expertly arranged into patterns and motifs, the paintings are distinctive. The art form is connected to the tattoo culture that is currently quite popular. The Hindi words Kalam and Kari both denote writing instruments. Beautiful bamboo pens that were created by artisans are used for this work. In Kalahasti, a town near Chennai, and Masulipatnam, a town near Hyderabad, this distinctive painting style developed. Kalamkari flourished and Persian influences could be seen in various pieces of art produced during the Maratha rule. Vegetable inks are the most prevalent source of paint. A more recent type, called Karuppur, is designed for royal households and features material that is embroidered with golden brocade. Madhubani Art, In Nepal's Mithila region and Northern India's Bihar, madhubani art is largely produced. The primary materials for the artworks are nib pens, branches, brushes, and, sporadically, even fingers and matchsticks. Women have also been producing art in the region for many centuries. The composition of the paintings is clearly geometric.

Gujarat, a cultural state, is located between latitudes of 22,000 North and longitudes of 72,000 East. One such traditional textile craft is Rogan painting. In Gujarat, Kutch. It is a traditional form of handicraft. Persian art has had an impact on contemporary art. The term "Rogan" literally implies Persian paintings made in oil. That's art was originally from Iran and sent to India, despite the lack of any historical proof or records to back up this claim. The Rogan craft was not limited to the Punjab border, but Hindus in Morvi and Ahmedabad in the President of Bombay were also performing it. Rogan painting is now only done in the Gujarati provinces of Kutch and Ahmadabad. Previously, it was also done in the Gujarati cities of Vadodara, Patan, Chowbari, and Khavada, as well as Nasik in Maharashtra. It is a seasonal craft used to embellish dowry items like bed linens, pillowcases, and blankets as well as wedding trousseau clothing like Ghaghara, odhana, chabla, and dharajo. In the past, only native colors were utilized, with minerals serving as the primary source. Rogan's paintings on fabric have an embroidery-like appearance. The surface application of paste, which has an impressed and glossy appearance similar to needlework, creates the illusion.

Indian traditional art is being faded out in favor of western culture. Therefore, it is important to make sure that Rogan painting, a traditional craft, is documented so that the younger generation can better understand their tradition and culture before it goes extinct. They do not make a respectable living from the limited number of Rogan-painted items that are now offered. Due to the high cost per unit, few products were largely purchased by international tourists. As a result, the craft was no longer practiced in the majority of the areas named since it posed a risk to the craftsmen. Consequently, the necessity to preserve the art in order to protect it and raise awareness of its age among younger generations is evident. Due to the poor production rates of traditional crafts like weaving silk, khadi, cotton, etc., dyeing, embroidery, etc., each of these crafts has been industrialized, and there has been a significant revolution in it. Every industry is growing simpler as a result. Mass production is now possible because of machine methods. Traditional craftsmanship is still being done, but industrialization is the only way to make it accessible to a wider audience. If it arrives and the buyer is satisfied, it can be considered acceptable.

2 Methodology of traditional Rogan art:

2.1 List of Raw material:

- Handio (an aluminum container)
- Dhakni (a covering plate made of mud),
- Chulah (furnace),
- Kanno (a plastic bowl used to contain Rogan color a paste)
- Kharal (a manual stone grinder)
- Castor Oil
- Natural Dyes (vegetable or mineral source)

1. **Handio (an aluminum container):**
   - Throughout history, vast volumes of Rogan were produced in large earthen pot vessels to create bold and large motifs and designs. Since the temperature required to create Rogan is over 200°C, the process can be highly dangerous and occasionally result in incidents where earthen pots burst at such temperatures, necessitating the repetition of the entire resin-making process. The craftsperson has switched to using aluminum containers as a result of this and the availability of other metal vessels; they, at the very least, do not burst under high temperatures.

2. **Chulah (Furnace):**
   - To start a fire to make Rogan gel, they used to dig a hole. Today, however, they use iron chulas, which are sold on the market. They are attempting to make up for the time spent in the field digging and manufacturing Chulah by doing this.

3. **Kanno (a plastic bowl used to contain Rogan color a paste):**
   - Once the Rogan gel has been created, it must be kept out of the air and in a container with water to keep it from drying out. A little amount of Rogan was created and is stored in a tiny plastic bowl holding water, which is quite easy to store and takes up less room, as opposed to the former technique of storage, which utilized large earthen pots due to the high quantity of Rogan gel.

4. **Castor Oil:**
   - Castor oil India is renowned as the producer of the most castor oil and seeds in the world and it dominate the commerce in castor oil internationally. In this nation, the annual production of castor oil varies typically between 250,000 and 350,000 tones. Gujarat produces the majority of India's castor seeds—about 86%—followed by Rajasthan and Andhra Pradesh. The principal regions for castor oil production in India are Mehsana, Banaskantha, and Saurashtra/Kutch in Gujarat and Nalgonda and Mahboobnagar in Andhra Pradesh. The amount of oil in castor oil seed is between 30 and 50 percent (m/m). Castor oil can be extracted from castor beans through mechanical pressing, solvent extraction, or a combination of pressing and extraction.
   - Extraction Pressing is the first stage of this extraction step. Prepressing typically entails the use of an oil expeller, a type of screw press. A high-pressure continuous screw press called an oil expeller is used to extract oil. Mechanical pressing results in only around 45% recovery of oil

from the castor beans, despite the fact that this procedure can be carried out at a low temperature. The extraction process may be more effective at higher temperatures. Up to 80% of the available oil can be extracted with the use of high-temperature hydraulic pressing.

- Filtration and purification of castor oil Even after the oil has been extracted using a press, contaminants are still present in the oil. Filtration systems are frequently used to help with the removal of the remaining contaminants. Large and microscopic particles, any dissolved gases, acids, and even water can be removed from the oil using the filtration systems. The filter press is the typical piece of filtration system equipment utilized for this operation. Castor seed oil can be refined and bleached to transform it from its natural pale yellow or straw color to one that is nearly colorless. Even though the crude oil has a unique smell, the odor can be removed during the refining process.
- Refining The crude or unrefined oil is then transported to a refinery for processing after filtering. Impurities such colloidal debris, phospholipids, extra free fatty acids (FFAs), and coloring additives are taken out of the oil during the refining process. The elimination of these contaminants helps to prevent the oil from degrading during prolonged storage. The degumming, neutralization, bleaching, and deodorization processes are all part of the refining process. By mixing hot water with the oil, letting the mixture settle, and then removing the aqueous layer, the oil is degummed. Repeating this procedure is possible. A powerful base, such as sodium hydroxide, is used for neutralization after the degumming procedure. After using hot water to remove the base, the aqueous layer and oil can be separated to remove the water layer. Bleaching is done after neutralization to get rid of color, residual phospholipids, and any oxidation products. The castor oil is next deodorized to get rid of any smell. If not exposed to extreme heat, refined castor oil normally has a shelf life of around 12 months.

5. **Natural Dyes (vegetable & mineral source):**
   - Vegetable dyes, which generate distinct pale to dark colors on both natural and synthetic fibers, are obtained from a variety of elements of plants and herbs, including the stem, wood, roots, bark, leaves, flowers, fruits, and skin of plants. Logwood, turmeric, pine wood, catechu, madder, and other significant examples of colors originating from plants or vegetables include.
   - Natural dyes made from mineral resources include mineral khaki, iron buff, Prussian blue, chrome yellow, chrome orange, and chrome green. Mineral colors are not dyes; instead, they are insoluble in water and are precipitated onto the fiber through twofold breakdown of the inorganic compounds. Cinebor (Sangraj), Red Lead (Sindur), Laminated Red Earth (Gem), Ultramarine (Lajerd), Zinc White (Sajeda), and others are significant minerals that are frequently used as natural dyes.

2.2 Production of Rogan :

Castor oil, wood, kerosene oil, and dyes were some of the components that were employed throughout the entire Rogan painting process. Traditional Rogan preparation involved a time-consuming procedure. Rogan took his time with each subsequent step in order to achieve the desired outcome. Since the process creates a strong odor and has an adverse effect on the lungs, it was only handled by skilled persons and performed at a remote location away from the residential area. In order to correctly prepare the Chula (furnace), which was the first step in this process, the craftsmen found a good location. After properly digging the ground, they gave it a proper coating of lime. After that,

they cleaned the area thoroughly and made the necessary handio after hours of cooking; one liter of castor oil is added.

The device is employed in the making of paste. The approach in a metal pot on the stove, begin by bringing the castor oil to a boil. Castor oil is added to the handi and heated in a furnace. To help them light the wood, they use kerosene. This cooked for a minimum of four hours, depending on the artisans asserted that the quantity of castor oil. The boiling process began after approximately fifteen minutes, and the artisans properly checked the temperature by continuously stirring the castor oil within the handio. At the same time, they cleared the surrounding area for the heated handio's proper placement to reduce the inside heat. After some time of stirring, the temperature of the oil increased; in order to lower the temperature, the oil was taken out of the Chula and placed aside. A flame would start to burn inside the aluminum vessel if the temperature increased over the desired level. As a result, the temperature was controlled to prevent these flames. According to the responses, the boiling procedure releases a foul smell that over time damages the craftsmen's lungs.

The castor oil begins to burn while it is being heated to a boil. As soon as the oil starts to burn, the handio (oil container) is taken out of the Chula and covered with dhakani. The oil ignites when the oil container is exposed because it comes into contact with oxygen. The castor oil is also refined since contaminants that were present before the boiling process were released in the fumes produced. Then, to extinguish the flame, the oil container was once more covered with dhakani to. The castor oil was turned into a thick paste-like gelatinous substance by repeating the same process several times. Following the necessary boiling, white particles could be seen on the oil's surface as it went through the process, which eventually started to take on a yellowish hue. Castor oil's color changes to a yellow hue at that point.

A wooden rod is used to gauge the consistency before it is taken out of the Chula and set aside. Finally, the Rogan paste is left in the shade for 5 to 6 hours to allow for thorough cooling and the formation of the gelatinous thick paste. While the artisans of Viramgam and Wadhvan bought the Rogan paste from them and completed their job for Rogan painting, the entire process of making Rogan paste was comparable in Ahmedabad. The preparation of a water bath, the blending of castor oil, and the quick preparation of the thick gelatinous paste of Rogan were the only two differences from the previous procedure.

2.3 **Preparation for dye:**

According to the responders, dyes were extracted from natural sources such as stone in the past and later from plant sources. Pure forms of colors including white, red, blue, yellow, green, and orange were used. Today, however, they use synthetic colors instead. It was seen that all of the artists were making the paste with napthol dye. Pavadi (yellow), Lal (red), Vadadi (blue), Safad (white), Leelo (green), and Bhuro(brown) were the colors used. Additionally, they employed binding agents and colored pigments. According to the hues of dyes, there were several price points for the dyes on the market. The craftsmen provided input at every step of the process.

According to the artisans of Nirona, the art of Rogan painting required a lot of time and was unhealthy. They said that highly competent craftsmen were required to make Rogan paste. Kharal, a hand-operated stone grinder, was the major piece of equipment for making color paste; it helped in blending the color paste. The manual grinding stone was completely cleaned so that there would be no leftover traces of the old paste before the fresh paste was made. In order to prevent even the tiniest stain of prior color in the fresh paste, this was done. The process of grinding the dye begins once the kharal has been cleaned, and water is subsequently added as needed. Up till a smooth paste is created, the grinding operation is continued. The dye paste was mixed with a little amount of gelatinous Rogan

paste. The dye paste is ground further until the Rogan is evenly combined with the dye paste and a soft, smooth, gelatinous paste is produced.

Fig.2.1 (Step by step making process of Rogan art)

Fig.2.2(Traditional rogan dye)

Fig.2.3 (Grinding process)

3 Lab scale

3.1 Apparatus & Equipments:

- Flat Surface stainless steel container
- Glass Rod
- Covering plate
- Induction stove
- Manual rounded stone hand grinder
- Fume Hood

3.2 Lab scale production of Rogan process:

Castor oil and natural colors were used, much like in the conventional method, but because the procedure was carried out on a lab scale, less castor oil was used, speeding up the time it took to get results. The procedure emits an unpleasant odor, as was already indicated. Due to the fact that this procedure is carried out in a lab, a fume hood has been utilized, which pulls out the harmful vapors to protect the operator. The 150 ml of castor oil is used at the process' beginning and is put in a steel pan. The pan will then be placed on the induction while the induction is still within the fume hood. Since

induction relies on electricity to operate, neither any initial fuel—wood or else required. Induction is set at 1600w during initiation. As the process continues, castor oil boils, causing toxic gases to be produced. Subjected to oxygen Causes Self-ignition is prevented by covering the container with a plate to prevent it from coming into contact with oxygen. Additionally, the voltage in the induction is lowered because the flashpoint can result in self-ignition. The voltage was lowered when the fumes started to increase. Long-term heating can cause it to burn and harden, which is not good for Rogan paint. We will maintain the voltage low to ensure that the process is gradual, balanced, and 3error-free. The viscosity of the castor oil from Glass road must be continuously monitored. The beginning of gelatinization is when a thin coating emerges on the surface. Keep the induction at the lowest voltage possible, stop it when it reaches the required gelatin phase, and leave the Rogan to cool for a while. The duration of this procedure is approximately an hour.

Fig.3.1(Castor oil)

Fig.3.2(Oil heating on induction)

Fig.1.6(Final rogan dye)

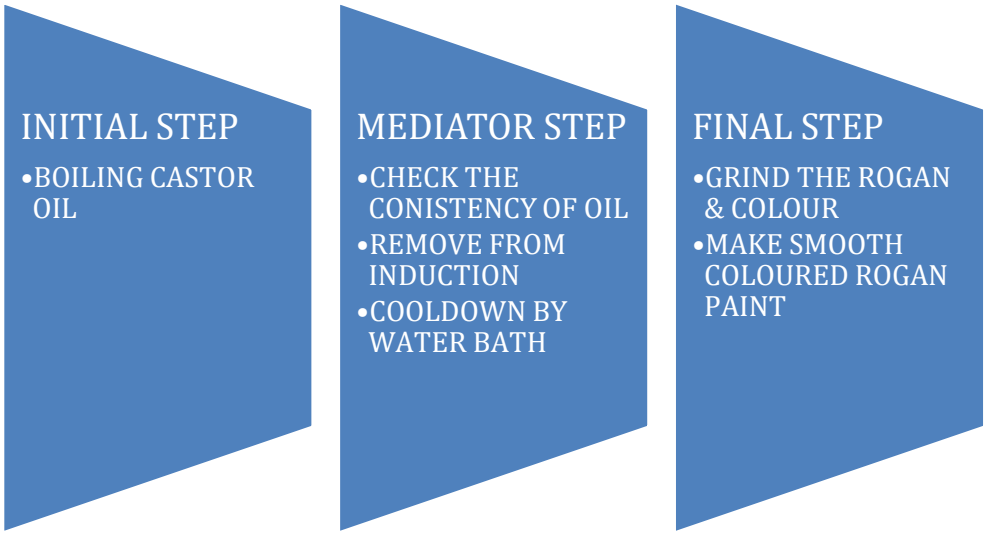
3.3 **Preparation of final dye:**

Making color paste has been done in the traditional manner using a round stone grinder. Following the application of organic dye to the Rogan, mineral dye may also be utilized. The dye is mixed with additional water supplied as necessary. The process of grinding continues until a smooth paste forms. A small amount of the Rogan paste's gelatin was combined with the color paste. A soft, smooth, gelatinous paste is created by grinding the dye paste further until the Rogan is equally distributed throughout.

Fig.3.4(Mortal and pestle)

Fig.3.5(Rogan paint)

3.4 FLOW CHART (MAKING PROCESS OF ROGAN PAINT IN LAB):



4 Pilot Scale method:

- **Purpose:**

Industrialization is the process through which an economy based on manual labor becomes an industrial society powered by machine labor. It entails a methodical transition from the rural economic structure to a sophisticated, automated mass manufacturing system. The gradual use of production techniques based on machines improves living conditions, increases productivity, and opens up new work prospects.

When materials like steel and iron, as well as energy sources like steam, coal, and electricity, are introduced on a big scale, mass manufacturing begins.

According to this goal, developing a concept is the first stage in industrialization. To make the concept successful, practice is required, and this is done on a small scale.

A pilot plant is a small-scale manufacturing facility designed to practically test and evaluate a production technique prior to commercialization. Typically, the main reason for setting up and running a pilot plant is to comprehend and investigate a new technology. Lessons learnt can establish valuable knowledge and data that leads to a larger or full-scale production facility that is safer, more effective, and economically feasible.

4.1 Required Equipments:

1. Reactor(stainless steel reactor)
2. Steam boiler or Furnace
3. Exhaust system
4. Heavy duty mixer(high viscosity mixer)

4.2 Reactor (Stainless Steel Reactor):

A typical stainless steel or batch reactor is a tank with an agitator and an integrated heating/cooling system. The volume of these containers can range from less than 1 liter to more than 15,000 liters. Typically, they are made of steel, stainless steel, glass-lined steel, glass, or rare alloys. Connections in the reactor's top cover are typically used to charge liquids and solids. Gases and vapors can also be released through connectors at the top. Typically, liquids leak out of the bottom. The batch reactor's adaptability is one of its main features. Without having to breach containment, a single vessel is capable of performing a variety of tasks. When handling hazardous or highly strong substances, this is especially helpful.

4.3 Steam boiler:

i) Fire heat Boiler
ii) Water heat Boiler

- Fire heat Boiler:

In a fire tube boiler, hot gases are passed via a number of tubes. A closed vessel contains these hot gas tubes submerged in water. A closed tank or shell that includes water is really used in fire tube boilers to transfer hot tubes through. Water is heated by these fire tubes or hot gas tubes, which then turn the water into steam, which condenses back into the original vessel.

A fire tube boiler cannot produce steam at very high pressure since the water and the steam are in the same vessel. In general, it has a maximum output of 17.5 kg/cm^2 and an hourly steam capacity of 9 metric tons.

- Water heat Boiler:

A water tube boiler is a type of boiler in which hot gases are used to surround the tubes that contain the water while it is heated. A water tube boiler can be characterized in this method. Utilizing more water tubes will result in a larger heating surface. Convectional flow causes water to move much

more quickly than it would in a fire tube boiler. As a result, there is rapid heat transmission, increasing efficiency. Smoothly obtaining a very high pressure of around 140 kg/cm^2 is possible.

4.4 Exhaust system:

One of the primary elements in charge of managing smoke and pollutants is an industrial exhaust system. In a brief, exhaust systems are devices that expel toxic air from inside spaces. Approaching an exhaust system can be done in a variety of ways.

4.5 Mixer (High viscosity mixer):

An ideal mixing mechanism is greatly influenced by viscosity. no matter what kind of viscosities are involved, we can produce accurate mixing solutions by customizing the agitator impeller design, the size and form of the mixing vessel, and the mixing speed. Because the ingredients have such high viscosities, a turbulent mixing phase cannot be produced without a significant amount of heat, hence high viscosity mixers are designed for mixing materials through laminar processes. The method can be applied to mixing pastes made of liquid and solid materials or high viscosity liquid to liquid mixing. Putties, chewing gum, and soaps are a few examples of items that may necessitate laminar mixing in a high viscosity mixer.

Fig.4.1 (Double planetary mixer)

Here the double planetary high viscosity mixer can be used to become Rogan pants.
Using two identical blades that rotate on their own axes while orbiting around a common axis, double planetary mixers mix materials. As they move steadily along the outside of the mixing vessel, the blades scrape material from the walls and carry it inside.
The blades that are typically employed have a bottom crossbar and a rectangular open-paddle shape, which makes it challenging to raise or lower them through a batch of material that has a high viscosity. Since many blade surfaces are passing one other simultaneously and with very small tolerances, the vertical flights of rectangular stirrers also produce a power spike in high viscosity applications.
Despite these features, twin planetary mixers with rectangular stirrers are still the go-to machines for processing viscous goods up to 3 million cP.

4.6 Ideal process:

The ideal data and conditions for the manufacturing of Rogan paint are presented by this procedure. This creates the opportunity for Rogan paints to be industrialized. These variables can be taken into account, and small-scale work can be done.

Understanding the physical characteristics of castor oil is crucial before undertaking the practice. Which are listed below:

Viscosity (centistokes)	889.0
Density (g/mol)	0.959
Boiling point (°C)	313
Thermal conductivity (W/m°C)	4.727
Specific heat (kJ/kg/K)	0.089
Flash point(°C)	229
Pour point (°C)	2.7
Melting point (°C)	-2 to -5
Auto ignition point (°C)	448
Refractive index	1.480

Here, a stainless steel reactor has been utilized to create Rogan paint since the process is not continuous and because the reactor has a greater heat transfer capacity than conventional batch reactors. Here, heating utilities can employ high pressure steam. Through a high pressure steam jacket, the reactor will be heated. Castor oil has a flashpoint of 229°C and a boiling point of 313°C, according to its physical characteristics. As a result, high pressure steam is required. Because high pressure steam can generate temperature about 250°C to 1200°C and the heat transfer coefficient of steam is higher than other utilities. The agitator will be taken out of the reactor because there is no requirement for mixing in this procedure.

Castor oil should be heated in the reactor until it reaches the same viscosity as the gelatin phase. A viscometer will be utilized in the reactor to measure the viscosity. It is important to test the sample from a range in order to determine the viscosity. The actual process of making Rogan will begin when the viscosity of castor oil reaches 10,000 cP. The viscosity of honey is 10,000 cP. In order to aid in the process of curing castor oil, it has been used as a comparison. Castor oil can self-ignite due to high temperatures if RTD is used in the reactor, hence it is imperative to continuously monitor the temperature inside the reactor throughout the processing. With the aid of an RTD, his internal temperature will be detected (resistance temperature detector). Reduce the high pressure steam if the internal temperature is getting close to the auto ignition point.

Then, as was discussed in the traditional method and lab scale, there is a chance that pressure will build up in the reactor as a result of the unfavorable gases that are emitted during the operation. The safety valve will open as a result of an increase in internal pressure if the pressure in the reactor rises. As they may make breathing difficult, these will be expelled through the exhaust pipe. An exhaust fan may also be used in association with reactor. Since the precise duration of how long the castor oil will produce Rogan is unknown while operating

on a pilot scale, it will be vital to monitor at the indicated intervals because the process may take less or more time to finish. Otherwise, the operation may fail. After becoming Rogan, castor oil has a very high ability to attach to the reactor wall.

As a result, after cooling for a while, water will be injected to the reactor; this will allow the Rogan to detach from the reactor wall and make exiting the reactor easy. It is challenging to color Rogan's because it is in a gelatin phase. It was simple to grind by hand in the old-fashioned manner and on a lab scale, but this technique is difficult in industry on a big scale. We may use the idea of food industries here. In the food sector, a high-viscosity bath mixer is employed. The Rogan is colored by mixing after being taken out of the reactor. The most effective mixer for combining Rogan with color is a double-planetary high-viscosity mixer, which is employed here instead of the customary hand grinder. The mixer will then start operating after that. To add color, we'll either utilize natural or mineral dyes. Since synthetic dye is readily available and relatively inexpensive, it can be employed. The dye is combined with water and added to the Rogan, which after several time will produce soft, lustrous Rogan paint and make it possible to create the desired product.

5 Result

Rogan paint was successfully manufactured in laboratory, providing a percentage conversion of 80%. Test shows that the traditional rogan and lab-produced rogan have nearly comparable characteristics and it can thus be used industrially for bulk production via suggested industrial methods.

6 Conclusion

Hence we can conclude that industrialization of rogan art is possible at Lab-scale providing a high yield of 80%. Properties were compared such as, the miscibility of natural color in Rogan was tested by combining small amounts of Rogan with natural color with the help of a stone grinder. As a result, Rogan became entirely miscible with the color.

Furthermore, Study can be done on applications of various imprint methods on different types of textiles.

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