Formic Acid for the Rubber Industry
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The Intermediates division of the BASF Group develops, produces and markets the world’s largest range of intermediates. Of the division’s more than 600 products, the most important include amines, diols, polyalcohols, acids and specialties. Among other applications, intermediates are used as starting materials for coatings, plastics, pharmaceuticals, textile fibers, detergents and crop protectants. Innovative BASF intermediates help to improve both the properties of the final product and the efficiency of production processes. The Intermediates division is ISO 9001:2000 certified and operates plants in Europe, Asia and the Americas.

BASF has over 30 years of experience in manufacturing Formic Acid. Its production facilities are based in Ludwigshafen, Germany and Nanjing, China. The Company is also building another Formic Acid plant in Geismar, U.S.A. which will start up in 2014.
High quality rubber sheets can be coagulated by using Formic Acid

Formic Acid is the preferred choice for coagulating latex: it is cost-efficient, and guarantees a consistent high-quality natural rubber product – making it one of the best coagulants for natural rubber latex coagulation in dry rubber production. Research has shown that natural rubber latex coagulation by using Formic Acid at an appropriate concentration and with recommended methods can produce high quality dry rubbers with good color, as required by dealers and manufacturers.

Advantages of using Formic Acid in rubber sheet production

- Cost efficient
- Superior performance
- Environmentally compatible

- Formic Acid is cost-efficient, and natural rubber latex can coagulate homogeneously;
- Formic Acid’s acidity is ideal for transforming latex into homogeneous dry rubber:
  - Weaker acids are less efficient, and result in much higher acid consumption;
  - Stronger acids make the pH drop too rapidly and non-homogeneously, resulting in uneven latex coagulation;
- No residue in rubber sheets;
- No effect on rubber elasticity;
- No effect on rubber performance in any rubber applications;
- Good color rubber sheets;
- Formic Acid is not too acidic or corrosive, making it safe to use; and
- Formic Acid is environmentally compatible. It is readily biodegradable and does not result in phosphate or nitrate loading of wastewater. It has low chemical oxygen demand (COD).

Properties of Formic Acid

BASF Formic Acid is commercially available at 85% and 94% concentration. Formic Acid’s properties include: colorless, excellent water solubility, and pungent smell.
Characteristics of rubber sheets formed using Formic Acid

- Clean, no acid spots, not sticky. No impurities, black spots, dirt, or air bubbles can be seen, even when a sheet is viewed against the light;
- The rubber sheets are dry, pale, and evenly colored, with no blemishes;
- The rubber sheets have regular and distinct rib-like patterns. When force is applied, they are soft, flexible, resilient and tough; and
- The sheets’ average thickness is 2.8–3.2 mm; each sheet is rectangular, with a width of 40–45 cm and length of 80–85 cm.

Procedures for making high quality rubber sheets

There is a simple over-arching principle for producing high quality rubber sheets: “keep the rubber clean”.

This can be achieved by keeping the natural rubber latex clean; and using clean equipment, clean water, and standard quality acid.

The process for making high quality rubber sheets is as follows:

Step 1 Collect fresh natural rubber latex

- Collection cups, latex containers or buckets should be cleaned prior to use;
- Do not collect rubber wastes, such as cup lumps or bark scraps, together with the latex in the latex containers, as these may cause latex coagulation and difficulty with latex straining;
- Place a lid on the container, to prevent latex spillage.
Step 2  Clean tools and equipment
- Tools and equipment used for making rubber sheets should be washed both before and after use.

Step 3  Latex straining
- To remove dirt, impurities and coagulum, double 40 mesh (top) and 60 mesh (bottom) sieves can be used to strain the field latex.

Step 4  Measure the latex into pans
- Three liters of sieved latex is measured into each pan or coagulation trough.

Step 5  Mix water and latex
- Three liters of clean water is poured into the pan, and mix with the latex.

Step 6  Select acid coagulant and acid dilution
- To homogeneously coagulate latex in order to produce high quality rubber sheets, use of standard BASF Formic Acid 94% is recommended. To coagulate latex within 30–45 minutes, an appropriate concentration of Formic Acid can be prepared as follows:
  15 ml of Formic Acid 94% is mixed with 1200 ml (approximately three cans) of water. Note that the acid is poured into the water. The concentrated acid must be stored in ceramic or plastic containers.

Step 7  Mix the diluted acid with latex
- Use a paddle to stir the latex once or twice. 400 ml (approximately one can) of diluted acid (from Step 6) is poured into and mixed in the pan. Use the paddle to stir the acid and latex about six times, to create a homogenous mixture.
Step 8  Remove froth
- During latex mixing, latex froth can be created. The paddle can be used to remove this from the pan. The froth can be collected and sold as good quality rubber scrap. If the froth is not eliminated, air bubbles will be present in the rubber sheets, lowering the rubber quality.

Step 9  Place a lid on the pan
- Coagulation pans should be covered with lids, to protect the rubber from dirt or impurities.

Step 10  Create initial rubber sheets
- Once the rubber has coagulated, it should be rolled to form sheets. Put a little clean water into the pan, to keep the coagulum wet and easy to remove. Initial sheets can be formed on a table with a clean stainless-steel covering, by using hands or hand operated rollers in order to form sheets that are approximately 1 cm thick.

Step 11  Use smooth rollers to create thinner sheets
- Smooth rollers are then used three or four times on each rubber sheet, to reduce its thickness to 3–4 mm.
Step 12  Imprint sheets using grooved rollers
- After the rubber sheets are passed through successive pairs of rollers (in a “sheeting battery”), to produce sheets of uniform thickness, appropriately grooved rollers are used to imprint “ribs” on each sheet, thus increasing the surface area to facilitate drying.

Step 13  Clean the rubber sheets
- The ribbed rubber sheets are then immersed in clean water, to eliminate surface impurities and dirt.

Step 14  Drip-dry the rubber sheets
- Wet rubber sheets should be hung from lines, so water can drip from them. Note that they should not be hung in direct sunlight, as this may cause rubber degradation and color changes.

Step 15  Store the rubber sheets and ready for sale
- Once the rubber sheets have almost dripped dry, they are typically hung from reapers and dried using natural ventilation. Good ventilation is essential to prevent growth of fungi.