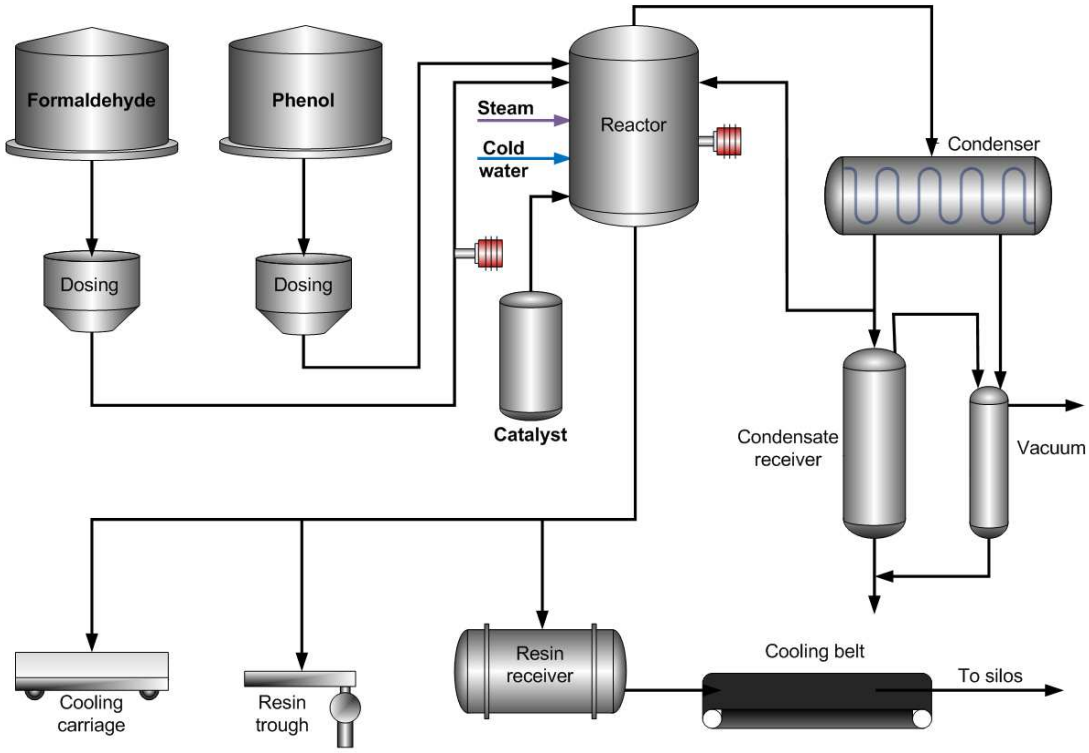
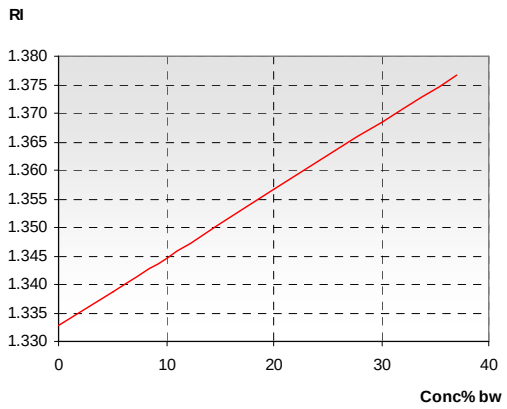


PHENOL C_6H_5OH, FORMALDEHYDE HCHO

Typical end products

Moulded products, coatings, bonding, Bakelite

Chemical curve: Formaldehyde R.I. per Conc% b.w. at Ref. Temp. of 20˚C



Introduction

Phenolic resins are formed by reacting phenol and formaldehyde. In the basic process, where a high ratio of formaldehyde to phenol is used, the result is a resole phenolic resin (base catalyst). When using an acid catalyst combined with a predominance of phenol, the result is a novolak phenolic resin. The production is either a batch or a continuous process.

Application

Novolak Resins:

In a conventional novolak process, molten phenol is placed into the reactor, followed by a precise amount of acid catalyst. The formaldehyde solution is added at a temperature of around 90°C (194°F), and a formaldehyde-to-phenol molar ratio of 0,75:1 to 0,85:1 should be achieved. For safety reasons, slow and continuous or gradual addition of formaldehyde is preferred over adding the entire charge at once. The reaction is completed after 6-8 hours at 95°C (203°F); volatiles, water, and some free phenol are removed. Because the free phenol content in the resin is a main determinant of resin properties, the final phenol content is monitored carefully.

Resol Resins:

Phenol and formaldehyde solutions are added simultaneously to the reactor at a molar ratio of formaldehyde to phenol of 1, 2-3,0:1. In the reaction phase, the temperature is held at 80-90°C

(176-194°F) and the reaction lasts 1-3 hours. When the desired end point is reached, the contents of the reaction vessel are cooled. In cases, when liquid resin is recovered as a 40-50 wt% water solution, the resin is refrigerated for storage.

The reaction steps are typically condensation, followed by distillation. Process temperature and the pH are closely monitored during the reaction. The Refractive Index gives an in-line indication of the reaction progress. In the distillation phase, the degree and completion of the reaction is determined by the Refractive Index.

Installation

The K-Patents Process Refractometer PR-23-GP measures the formalin concentration before the reactor.

In a batch or continuous reactor, the refractometer is used in the distillation phase to monitor the degree of reaction, reaction progress and to determine the end point of the reaction.

The K-Patents refractometers offer precise and reliable measurements. By using a special YAG prism, Refractive Indexes as high as 1,63 can be verified. The K-Patents refractometer is the only available refractometer capable of measuring this high a Refractive Index.

In both applications, the continuous measurement offers valuable real-time information for process control. Automatic prism wash with steam or high pressure water is recommended. Appropriate equipment with hazardous and intrinsic safety approvals are available when required.

Instrumentation	Description
	K-Patents Process Refractometer PR-23-GP is an industrial refractometer for large pipe sizes and tanks, cookers, crystallizers and kettles. Installation through a flange or clamp connection.
Automatic prism wash:	**Prism wash with steam:** The components of a steam wash system are a sensor with integral steam nozzle mounted at the sensor head, a shut-off valve for steam line and an indicating transmitter equipped with relays to drive the wash valves. **Prism wash with high pressure water:** The components of a high pressure water system are a sensor with integral water nozzle mounted at the sensor head, a high pressure pump together with a power relay unit and an indicating transmitter equipped with relays.
Area classification:	Intrinsic safety and hazardous area approvals available.
Measurement range:	Refractive Index (nD) 1.3700 – 1.6300, corresponding to 0-100 % by weight.