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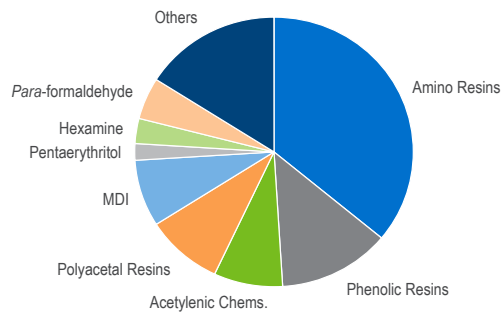
## PERP Report 2016-2: Formaldehyde and Resins

“Formaldehyde and Resins” is one in a series of reports published as part of the 2016 Process Evaluation/Research Planning (PERP) Program.

### Report Overview

Formaldehyde is a naturally occurring organic compound that is commercially produced from methanol. It is considered a low-cost industrially significant product that is utilized to manufacture numerous consumer articles and in industrial products. The major demand drivers are the construction, furniture, and automotive industries. The cost and difficulty of transporting formaldehyde over long distances has resulted in many formaldehyde plants integrated with downstream derivative plants and minimal inter-regional trade. Major formaldehyde applications are phenolic resins (novolac and resol) and amino resins (urea-formaldehyde and melamine-formaldehyde). The formaldehyde and resin industries are fairly mature.

### GLOBAL FORMALDEHYDE DEMAND BY END USE



This PERP report provides an overview of the technological, economic, and market aspects of formaldehyde and the major formaldehyde resins. The resins focused on are phenol formaldehyde (PF), urea formaldehyde (UF), and melamine formaldehyde (MF), the three largest volume resins. The following issues are addressed in the report:

- What are the major technologies for formaldehyde and formaldehyde resins? How do they differ?
- How do the process economics compare for formaldehyde and the different resins across different geographic regions?
- What will the expected global consumption of formaldehyde be in 2020 and what region will have the highest growth?

### Commercial Technologies

The major commercial routes for the production of formaldehyde are based on the partial oxidation and dehydrogenation of methanol using a silver catalyst or the partial oxidation of methanol using a metal oxide catalyst. Most commercial formaldehyde resins are produced by batch processes, which are typically represented by two steps. The first step is an addition reaction between formaldehyde and a comonomer (phenol, urea, or melamine in this report), and the second step is a condensation reaction between either intermediate components from the first step or intermediate components and additional raw materials.

Profiles of some of leading licensors and technology providers, such as Alder, Chimar Hellas, DB Western, Dynea, Halder Topsoe, Johnson Matthey, and Josef Meissner are included.

### Process Economics

Detailed cost of production estimates for the USGC, China, and Western Europe are presented for:

- Formaldehyde, metal oxide catalyst process
- Formaldehyde, silver catalyst process, complete conversion without methanol recycle
- Formaldehyde, silver catalyst process, incomplete conversion with methanol recycle
- PF Resin, novolac and resol, batch process
- UF Resin, batch process
- MF Resin, batch process

### Commercial Market Review

Global formaldehyde consumption in 2015 was about 45 million tons with amino resins and phenolic resins the major end uses. This PERP report provides an overview of the supply, demand, and trade of formaldehyde on both a global and regional basis, and global end use breakdowns for each of the main resins

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