ABSTRACT

Acetic acid production shifted toward methanol carbonylation with the advent of Monsanto’s development of the “high water” rhodium-catalyzed process. Since then, the technology has developed and is starting to diverge along different paths. The “low water” processes provided a significant boost over the original Monsanto technology, but various companies have begun pursuing individual approaches. Celanese has continued the rhodium-catalyzed route for the homogeneous catalyst, while BP has focused more on the homogeneous iridium catalyst. Chiyoda is also working on rhodium-catalyzed technology, but formulated as a heterogeneous catalyst instead. Each company claims advantages and each continues to develop improvements for their technology, but all of the technologies appear to offer similar performance. So while the “low water” processes are clearly more economical than the “high water” process or older technologies, the individual “low water” technologies appear to be basically equivalent from the conceptual design viewpoint.

Celanese and BP together appear to dominate worldwide capacity, with Celanese operating in the Americas and BP in Europe. Asia is split, with Celanese in China and Singapore, and BP in Korea, Malaysia, and Taiwan. However, BP’s sites appear to be mainly joint ventures with local companies [CEH602.5000, CMAI120418, CMAI2011WAA]. The largest growth in acetic acid volume though, stems from Chinese companies adding capacity for growing Chinese demand. Chiyoda’s heterogeneous catalyst technology has yet to make a significant impact on worldwide capacity, but their willingness to license the technology may begin to make a difference. Celanese appears to be reluctant to license their technology, while BP has entered several joint ventures in Asia, although they have not licensed to others. While the growth outside of China tends to belong mostly to Celanese and BP, the growth in China mostly belongs to Chinese companies, only some of which have ties to Celanese or BP. The remaining Chinese producers seem to use older technologies, like Monsanto’s “high water” process, or reengineered “low water” processes.

This review explores the effects of new technology and economy of scale on the Celanese process, since this process was last evaluated over a decade ago. World scale at the time was 400 thousand metric tons per year (kta), and both BP and Celanese technologies were evaluated at that level [PEP037C]. Since then, world scale has risen to 650 kta [CEH602.5000, CMAI120418, CMAI2011WAA] at one Celanese facility in Singapore. Other 600 kta plants are operated in China by Celanese and Jiangsu SOPO.

Celanese facilities are migrating toward the 600 kta range, while BP facilities remain at 500 kta. Incremental improvements continue to be developed, but Celanese seems to be setting the new world scale. This review updates the Celanese technology to 600 kta capacity, and includes recent technology developments illustrated in new patents and applications.
ACETIC ACID, UPDATE OF THE CELANESE AO PLUS PROCESS

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February 2013

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