

Bio-based aniline: scale-up of a sustainable innovative route to a strategic raw material

Thomas Voessing, Covestro Deutschland AG

Covestro has the goal to be fully aligned to the circular economy which means to switch to alternative raw materials to manufacture its products. The company is pursuing this approach in order to reduce its dependence on traditional fossil resources and to become climate neutral. Plant biomass, carbon dioxide and carbon-bearing waste streams are promising alternative sources of the key element carbon.

Against this backdrop Covestro is pursuing new avenues to produce aniline from sources other than petrochemicals. Aniline plays an important role in the chemical industry. Among other applications, it is used for the synthesis of highly efficient insulating materials used in buildings and refrigeration systems as well as for the production of rubber and medications. More than six million metric tons of aniline are annually produced worldwide from fossil raw materials. This is done in a multi-step process, with crude oil first being refined into naphtha and then processed into benzene. In the next steps, the substance is nitrated to yield nitrobenzene, which then is hydrogenated to aniline.

In a new process, Covestro, together with its academic partners, has successfully used plant-based raw materials to produce aniline. The process comprises two innovative catalytic steps. In the first step, unrefined industrial raw sugar and ammonia is converted by microorganisms into an intermediate product under mild conditions. Metabolic engineering has been applied to optimize the metabolism of the applied microorganism. A chemocatalytic step is then used to convert this intermediate product into aniline. Having been proven in piloting-scale, the new process concept is now ready for the next scale-up steps. The bio-based aniline produced this way can be used as a direct drop-in chemical for conventional aniline.