

Abstract

A case study of the treatment of 4-chlorophenol using biomass within batch reactors was performed. Two modes of operation for the batch reactor were considered, discretely fed and continuously fed. In each mode of operation, attempts were made to minimize the total network reaction time for the treatment process. We considered the case where the initial condition of 4CP and biomass were 1400 milligrams per liter and 2542 milligrams per liter, respectively, with a performance target of 99% conversion of 4CP. For the discretely fed case, a reactor network with a total reaction time of 2,171 hours was the lowest found. The minimum total reaction time was approximated to be around 1,980 hours with the use of the batch attainable region, but a corresponding reactor network was not found.

For the continuously fed case, a feeding scheme with a total reaction time of 1,707 hours was the lowest found. We then considered multiple cycles of the 4CP treatment process and attempted to maximize the treatment rate by taking some of the product from each batch reactor and mixing it with the feed for the next batch. In this manner, an analysis of the treatment rate when the dilution rate was constant was performed; this treatment rate was found to be 35 times higher with extra cycles compared to when there were no additional cycles.