Modeling and Analysis of Dead Volume Effect in Industrial Scale SMB Process for p-Xylene Separation

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A simulated moving bed (SMB) model is developed for an industrial scale p-xylene separation SMB plant, where dead volume has to be taken into account. Dead volume associated with surrounding equipment volume, which can be classified by bed head, bed tail, and bed line, has negative influence on purity and recovery of SMB units. In this work, the PAREX process with flushing techniques was analyzed. The PAREX configuration consists of 24 adsorbent beds and 24 single bed lines connecting the adsorbent beds to rotary valve. Each bed line is used to introduce and to withdraw the process streams (desorbent, extract, feed, and raffinate) resulting in contamination of the line streams. A flushing operation strategy of 7 or 8 zones was presented to achieve this flushing technique. The flushing flow rates have to be adjusted to increase purity and recovery. In this study, the effect of diffusion inside dead volume on flushing flow rates is investigated.