Study of RTD curves in packed column using radiotracers

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All industrial product is generated from a variety of materials related to an appropriate sequence of processing steps. However, for this product is economically viable control of the entire production process must be done rigorously. In many cases, the technological parameters describing the unit can not be theoretically be measured because the analytical equations that describe the system not precisely determine the physical-chemical parameters of the material present in a system. In this context is that the methodology of radiotracers is presented as one of the most appropriate equipment for providing specific data unit being able to determine the dynamics of fluid within the unit in real time.

The objective is to develop methodology using radiotracers for liquid phase profile analysis in a column packed. Using a radiotracer input stimuler and positioning properly NaI(Tl) scintillator detectors externally to the column is possible to evaluate a the flow profile of the liquid phase.

The use a radiotracers for modeling that describe the operating conditions in a packed column is of great importance. Because the that these models can be used in the identification of situations of operational failures inside the packed column, from the behavior of the answer curves of the unit. These curves are characterized by Residence Time Distribution (RTD).

The fundamentals of this methodology is that each particle of the radiotracer, when it traverses the unit under study, has its "history", according to the time it remains inside the system, associating the probability density functions (ageing functions), making possible relate the profile of their displacement by unity [1].

The curve E (t) represents the age distribution of fluid elements that left the unit at a certain time t. The hatched area shows the average residence time, see Figure 1 [2].

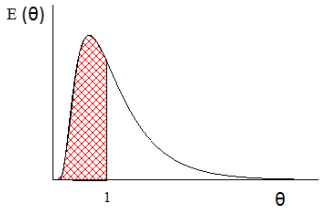

Figure 1. Typical E (θ) curve measured by the radiotracer technique

The experiments were performed on laboratory scale using a column consisting of an acrylic tube having 10.16 cm in internal diameter and 43 cm in height and acrylic beads with 0.7 cm in diameter. Water was used in the transport line that feeds the column and injections was made with the ^{68}Ga radiotracer. In the Figure 2 are shown the system response curve for flow rate of 200 L.m^{-1}

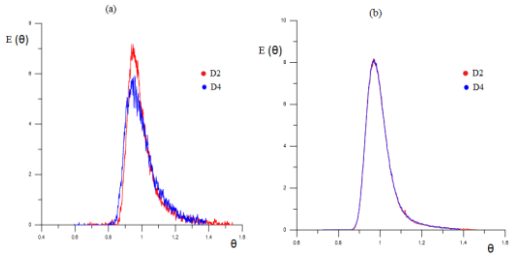

Figure 2. System response: a) empty column; b) packed column

The technique used for pulse injection with the radiotracer used was efficient to characterize the RTD curves. For the experiment with the empty column, that is, the column without the presence of the spheres of acrylic, showed the presence of retention zones and channeling, characteristic of the column. However, for the experiments with the packed column with the acrylic beads, it is observed that there is a uniformity of behavior presented by the flow. As noted by response curves.

References

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