Hydrodynamics and Similarity Study on an Ebullated Bed Reactor

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I. Abstract

The ebullated-bed reactors exemplify zenith in the evolution of hydroprocessing reactors. The activity and efficacy of industrial hydro-processing ebullated bed reactors are highly rely upon the bed hydrodynamics and operating conditions. The main objective of this research was to investigate the hydrodynamic parameters (e.g., phase holdups and bubble features) in an industrial-scale ebullated bed reactor through operating a cold lab-scale ebullated bed three- phase column designed using a similarity technique through a five dimensionless groups. The results of a dynamic similarity test showed that the experimental data obtained from the cold model could be utilized in the investigation of a large scale unit (e.g., in H-Oil process licensed and commissioned by Axens Company at Refinery of Lukoil, Burgas, Bulgaria) within a reasonable accuracy. Air, magnesium sulfate aqueous solution and solid catalyst particles were used as the gas, liquid and solid phases respectively. Pressure drop technique was applied to determine the phase holdups and bed voidage across the column, meanwhile photographic technique was used to gain snapshots of the mobile gas bubble. The snapshots were analyzed employing Ai Adobe illustrator CC (64 Bit) software to mark the bubbles geometric features. Empirical correlations were developed for prediction of phase holdups and bed voidage with high precision. The outcomes revealed that liquid internal recycle ratio, which distinguished the ebullated bed reactors has a preponderant influence on the phase holdups and bubble volume. A good conformity was found between the present results and published data in the literature.

II References

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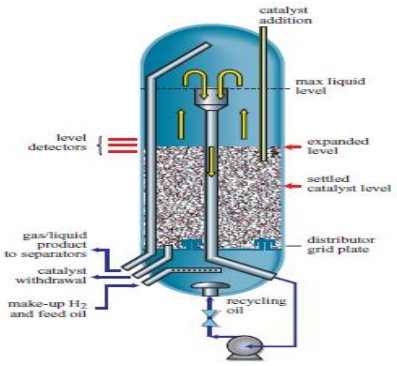


Fig.1 Diagram showing how an ebullated bed reactor works

IV. Biography:

Mohammad F. Abid is Professor Dr. Eng. at the Chemical Engineering Department, University of Technology Baghdad. He got his PhD in Chemical Engineering /Unit Operation in 2002. He served as Head of Unit Operation Branch from 2006 to 2012, as Head of Pioneer Research Unit since 2014, and as Head of Chemical Engineering and Environmental Pollution Branch since 2015. He authored four text books and over 40 journal articles



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