

FILTER SELECTION, SCALE-UP AND SIMULATION IN THE 21st CENTURY

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ABSTRACT

Basic liquid filtration data can be obtained in laboratories with relatively elementary equipment, an example being the single leaf filter operating at either constant under- or over- pressure. In some cases it is possible to collect data for sequential operations such as those constituting a filter cycle, though performing these experiments manually gives limited information and can introduce significant errors unless great care is taken. The need to manually perform tests and adjust operational parameters to maintain chosen experimental conditions are variables that, in conjunction with variations in data analysis, often lead to the use of 'rules-of-thumb' by filter manufacturers.

The development of more sophisticated filtration apparatus has facilitated both improved test methodologies and more detailed measurements. For instance, manual operation can be replaced by a combined electronics, computer technology and automatic control philosophy to facilitate experiments over any chosen pressure/flow regime without altering suspension properties. Even with the availability of such apparatus, process scale filtration equipment is rarely specified without recourse to a significant number of laboratory and/or pilot scale tests. However, if a consistent approach is not taken then poor specification and sizing of filters can result, required production rates may not be achieved and unforeseen difficulties sometimes arise in filter cycle operations. Against such a background a combined theoretical and experimental approach has led to the development of computer software to facilitate better filter selection, scale-up and process simulation (e.g. Filter Design Software). Raised levels of sophistication introduce new research opportunities, allow more consistent and accurate data to be obtained and provide an impetus for further developments.

The paper details recent developments in equipment for the automated testing and monitoring of cake filtration and the filter cycle, and shows how the level of sophistication can be varied according to requirements. The integration of reliably obtained test data with interactive computer software is also used to illustrate a robust approach to equipment selection and scale-up. The paper shows how this information can subsequently be used in conjunction with process modelling to simulate detailed filter cycle operations on batch and continuous cake filters. The approach has general application within process and related industries and offers integration with manufacturers data via the world wide web.