

RESEARCH AND OPTIMIZATION OF FILTRATION PROCESSES

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Filtration and membrane technology are dynamically developing aspects of solid/liquid separation. There is a constant growth of scientific research work and design studies in this field of chemical engineering.

It's possible to speak now about the revival of this branch of chemical engineering, absorbing new original ideas from various branches of science and techniques. The work is devoted to the analysis of the most promising directions of filter building and some experimental research in filtration technology.¹

Fluid/Particle Separation Journal, 4, 174-175. (1991).

FILTRATION AS FLEXIBLE TECHNOLOGY

The basic principles of filtration as flexible technology were formulated on the basis of analysis of chemical engineering practices. (Yelshin, 1990a). Three tendencies in designing of the filtering equipment were analyzed:

1. Apparatus which combines heat-and mass-transfer and filtration in the same unit.
2. Application of robotic principles to the automatic operation of filtering equipment, thereby solving the problem of the use of filters in dangerous conditions.
3. Application of rotational (sequential) machines and rotary-conveyor systems in filtration processes. For example, the attention can be fixed on filtration systems when sludge treatment by filtration is based on principles employed with rotational casting molds. The filter elements are used as containers for sludge. The filter elements pass through different processing zones in the rotational machine in consecutive order. For instance: loading, filtration, expression or drying, fixation (sintering, impregnation), and packing (coating, encapsulation, spray coating, etc.) can be accomplished in a single machine (Yelshin, 1986A, 1990B). Some ideas were expanded to filtration in space industrialization.

FILTRATION AND OPTIMIZATION

Different aspects of filtration were considered in this field. For instance, some problems of non-Newtonian liquid filtration were considered as well as possible optimization of this process (Yelshin, 1986, B,C).

¹ *F/PSJ* asked Dr. Yelshin to review some of his work in solid/liquid separation. He spent a year at the University of Houston and presented a paper at the Second Annual Meeting of AFS in Pittsburgh. Mrs. Yelshin came to the U.S. with a group of wives of visiting scholars and spent a month in Houston.

The role of slurry concentration in filtration was shown (Yelshin, 1988). For some types of slurry, the optimum concentration of solids which gives the maximum productivity of a filter can be found. The subsequent joint research with Dr. Frank Tiller at the University of Houston (1988-89) showed that there is a complicated correlation between cake compressibility and slurry concentration. This correlation demands further careful investigation. Cycle optimization of batch filters was done (Tiller and Yelshin, 1989). A review of filtering equipment in the USA was made for Russian experts as a result of my visit to the University of Houston (Yelshin, 1990C, 1991).

New types of filter media and their application for filtration were developed during research of 1986-1990 on the level of inventions.

BIOLOGICAL SLURRY

Review and analysis of different methods of biological slurry thickening and filtration showed that filtration and membrane technology are the most dynamically developing branches of separation in the microbiological industry (Yelshin, 1987). For perfection of separation processes, filtration properties of some microbiological slurries and methods of their effective coagulation were developed (Yelshin et al., 1986D; Grichenco et al., 1988) As a result, it was determined that thickening by filter-thickener or cross-flow filtration were the most suitable operations for highly compressible, biological slurries. Good results were obtained when knitted synthetic filter cloth was used (Yelshin et al., 1986D). High degrees of thickening can be reached with the help of cell volume control by using the osmotic phenomena in biological slurries (Yelshin (1986G)).

The data obtained during the research allowed us to get more than 15 patents in the USSR in different fields of filtering equipment and filtration processes.

ACKNOWLEDGMENT

Research Work No. GB-1286, State registration No. 01.86.0029179.

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