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Opinion Article

The Significance and Characteristics of Membrane Fouling

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DESCRIPTION

Membrane Fouling (MF) is a procedure by which molecules, suspended particles, or solute macro molecules are placed or absorbed by the body on to the semipermeable membrane or surfaces through chemical and physical interactions or mechanical treatment, resulting in reduced or blocked membrane pores. Membrane fouling can cause significant permeability drops as well as an impact on the quality of the water produced. Severe fouling can require a detailed removing work or membrane replacement. This generates a treatment plant's operational costs. Membrane fouling is assumed to occur or through three different mechanisms: Porous structure stopping, pore constriction, and cake establishment. Contaminants are classified as biological (bacteria, fungi), colloidal (clays, flocs), scaling (mineral precipitates), or organic (oils, polyelectrolytes).

Many factors determine membrane fouling, which include: (1) particle or solute size; (2) membrane microstructure; (3) interactions between membrane, solute, and solvent; and (4) surface integrity, permeability, and other physical properties of the membrane. As a result, humans should always: (1) To select appropriate membrane materials; (2) To select structure; (3) pre-treatment of raw materials; (4) enhancement of operating conditions; (5) control of inorganic salt solubility; (6) rinsing the membrane regularly; (7) the use of a removing solution; (8) increasing feed water temperature; and (9) proper maintenance and treatment.

Depending on the particle connection stability to the membrane surface, fouling is classified as either reversible or irreversible. A strong stress concentration or backwashing can be used to remove reversible fouling. During a continuous filtration process, the formation of computerized environment of fouling surface with the solute will result in reversible fouling becoming transformed into an irreversible fouling layer. The strong connection of particles that cannot be removed by physiological disinfect is referred to as irreversible fouling.

Factors that affect membrane fouling

According to biological study, membrane fouling is affected by a wide range of factors such as system flow characteristics, operational characteristics, membrane characteristics, and properties of the material (solute). Concentration polarization effects are minimal at low pressure, low feed concentration, and high feed velocity, and flux has been almost directly proportionating to trans-membrane differential pressure. In the high-pressure range however, flux becomes almost independent of pressure applied. Concentration polarization creates the difference from the linear permeability connection. Also at relatively low pressures, the limiting permeability condition is observed at low feed flow rate or high feed concentration.

Although membrane fouling is an inevitable development during membrane filtration, it can be reduced through techniques such as removing, appropriate membrane classification, and operating condition classification. Decontaminating membranes can be performed manually, biologically, or chemically. Physical assistants techniques consist of the use of an energy deformation, displacement, high pressure water, or back flushing with permeate or filled with air. Biological servises utilize biocides to remove all sustainable micro-organisms, whereas solvent extraction utilizes acids and bases to eliminate organic pollutants and impurities.

A further technique for preventing membrane fouling is to select the effective membrane for the operation. This phenomenon of the feed water must be determined, and then membrane less susceptibility to fouling with that solution is identified. A hydrophilic membrane is desired for solvent filtration. A permeable membrane is preferred for membrane distillation. Operating conditions are also important during membrane filtration because they can affect fouling conditions during filtration. For example, cross flow filtration is frequently desired over dying industry filtration because require more extensive during the filtration effects in a relatively thin surface and therefore reduces fouling for example tubular pinch effect. Air scour is used to promote airflow at the membrane surface in some applications, such as many Bioreactor applications.

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Membrane fouling has a significant impact on membrane flux and it has been extensive research. In general, membrane fouling can be controlled by using two techniques: (1) reducing the fouling rate and (2) Removing membrane fouling. Membrane fouling can be reduced by pre-treatment of industrial effluents, improvement of specific operating conditions, affecting raw sewage characteristics, and improving membrane properties.