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LINEAR MODEL APPROACH TO ANALYZE RADIAL ACCELERATION EFFECTS OF MEMBRANE THICKNESS IN SPIN COATING

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Achieving the desired properties of the membrane fabrication using the spin coating method requires precise control of coating thickness. While a general equation exists for coating thickness based on angular velocity, the significant influence of radial velocity and radial acceleration of the rotor remains critical, especially considering the non-constant nature of radial velocity. The aim of this study was to develop a mathematical model that explains the relationship between film thickness and radial acceleration in spin coating, assuming constant angular velocity and other key parameters, such as temperature, pressure and solution concentration. Using MATLAB software, data on the acceleration, deceleration and spin time of the rotor measuring the coating thickness were entered as output. By plotting the radial velocity vs. rotation time, Equation (1) describing the relationship between the area under the curve and the radial acceleration (*f*) was obtained. Then, by integrating the area under the velocity-time curves for the radial velocity change, Equation (2) correlating the integrated area (*x*) to membrane thickness (*y*) was generated.

$$\text{area} = \left(\frac{6480000}{f}\right) + 113400 \qquad (1)$$

$$y = 4.3573 \times 10^{-4}\, x + 9.8653 \qquad (2)$$

Further analysis involves replacing the variable *x* (representing the integrated area) in Equation (2) with the expression derived from Equation (1), yielding the final linear equation (3) that correlates membrane coating thickness (*h*) directly to radial acceleration (*f*). This new approach bridges the gap between process parameters and membrane properties, providing valuable insights for optimizing membrane fabrication processes.

$$h = \frac{2823.5}{f} + 59.2771 \qquad (3)$$

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