Hydrodynamics of Shaking Baffled Cylindrical Vessel with Rotary Motion

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The hydrodynamics of a shaking baffled cylindrical vessel with rotary motion was studied by the observation of the height of wave and the particle dispersion in the vessel. The phenomena of suddenly decreasing wave height can be observed at one shaking frequency in the case using the baffled vessel. This frequency can also be correlated with only Froude number and baffled conditions, and it did not depend on the Reynolds number. And it found that the operating condition becomes narrow by comparison with the non-baffled vessel.

Hydrodynamics in Baffled Shaking Cylindrical

\[
Fr_{\text{max,}P} = 0.44(B_W/D)^{0.17}(n_B)^{0.24} (d/D)^{0.51}
\]  \hspace{1cm} (1)

\[
N_{p} = 1.8 \times 10^3 Re^{-0.25} Fr^{1.5} (d/D)^{1.5} (B_W/D)^{0.13} n_B^{0.3} \quad (P>0.5W)
\]  \hspace{1cm} (2)

- \(N_{\text{max,}P}\) did not depend on the viscosity of liquid.
- The power consumption of baffled vessel was higher than that of non-baffled vessel in the range of the shaking frequency when the rotational flow developed in the vessel.
- The correlation deviation of Eq.(2) was almost equal to that of the non-baffled vessel.

Fig. 1 Effect of shaking frequency on wave height \(D=200\text{mm}, B_w=10\text{mm}, d=10\text{mm}, \text{water}\)

Correlation of Shaking Frequency of Maximum Power Consumption and Power Number

\begin{table}
\begin{tabular}{|c|c|c|}
\hline
\textbf{D [mm]} & \textbf{\(N_{\text{max,}P}\) (cal) [s\(^{-1}\)}} & \textbf{\(N_{\text{max,}P}\) (obs) [s\(^{-1}\)}} \\
\hline
140 & 170 & 200 & 240 \\
\hline
\end{tabular}
\end{table}

Fig.2 Comparison of calculated \(N_{\text{max,}P}\) with observed one

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\begin{tabular}{|c|c|c|}
\hline
\textbf{D [mm]} & \textbf{\(P\) [W] (cal)}} & \textbf{\(P\) [W] (obs)} \\
\hline
140 & 170 & 200 & 240 \\
\hline
\end{tabular}
\end{table}

Fig.3 Comparison of calculated power consumption with observed one