

The Influence of High Solids Loading Concentration and Scaling-up Operation in Coal Slurry Just-Suspended Agitation by High-Efficiency Impellers

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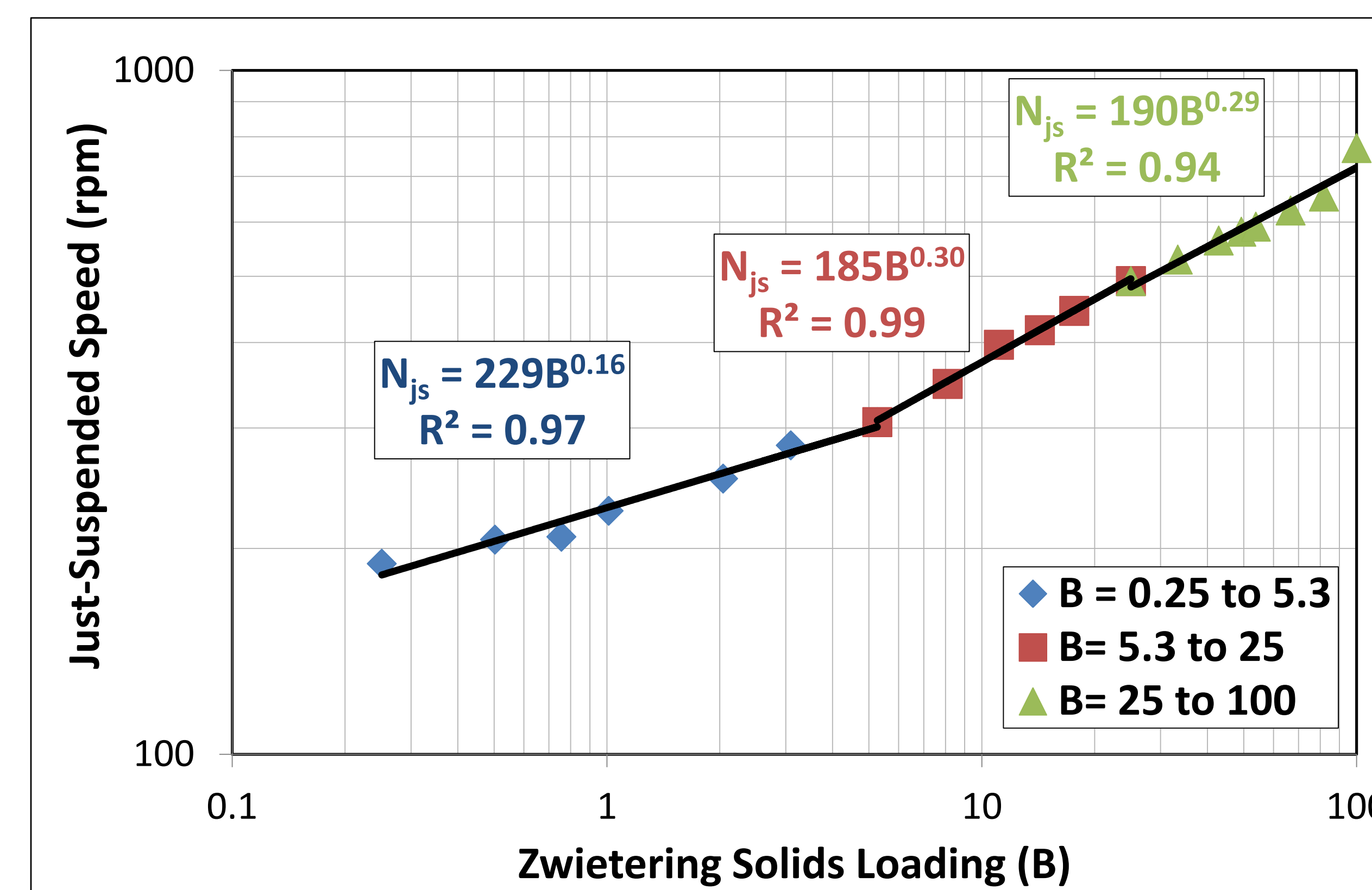
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System Geometries

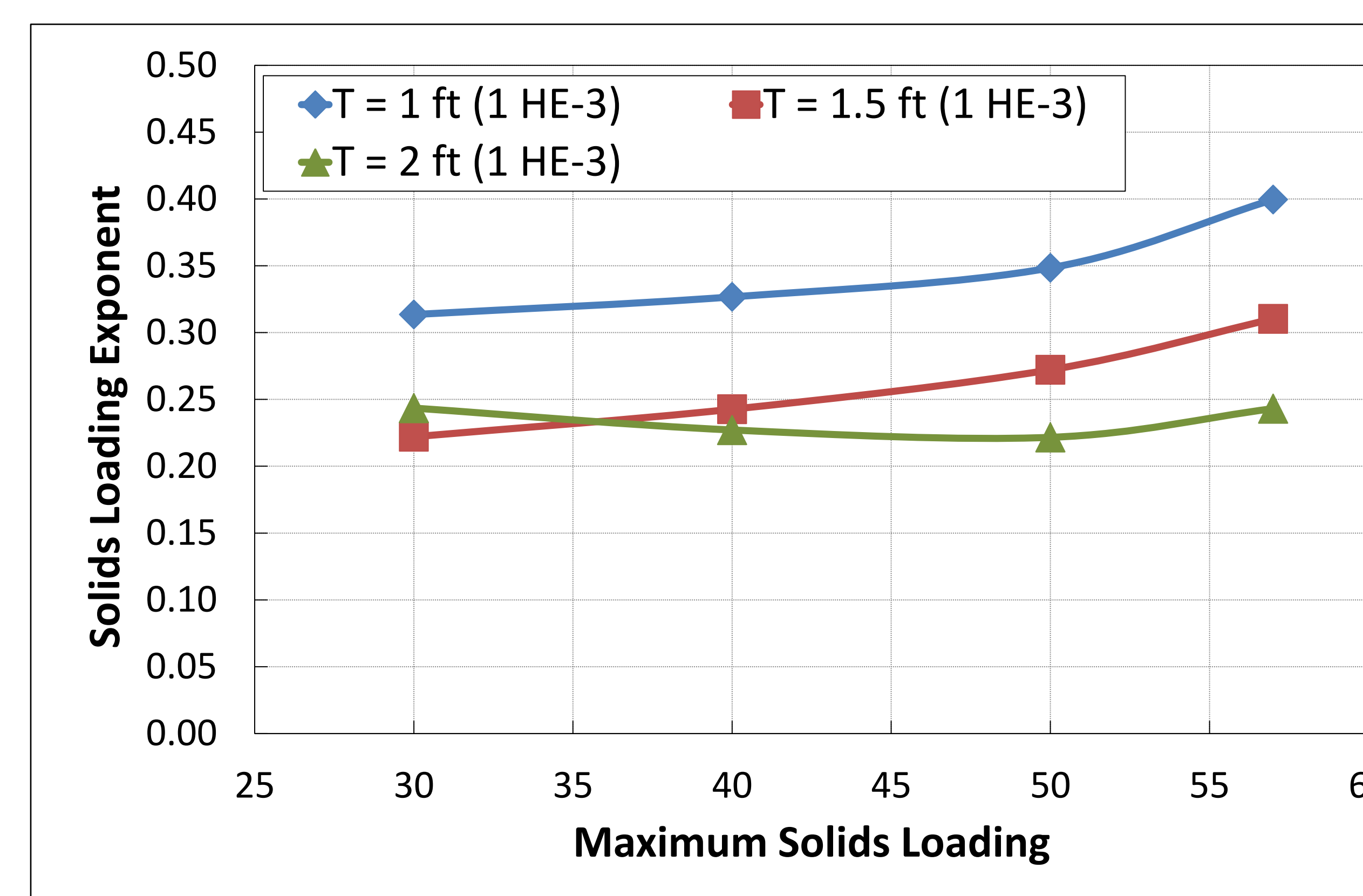
Tank Diameter	Single Impeller System	Three Impeller System	
T (inches)	D (inches)	d (inches) for Top Two	d (inches) for Bottom
11.4	4	3.5	3.75
17.4	6	5.25	5.75
23.4	8.25	7.25	7.75

Results

1. Solids Loading Effect



2. Scale Up Effect



Introduction

The just-suspended condition is defined as the minimum speed that all particles are in motion and no particle remains on the vessel base for more than 1 to 2 seconds. Zwietering developed a correlation for just-suspended speed that indicated that it was affected by various parameters, such as solid and liquid properties and impeller characteristics, with each effect being presumed to be independent.

Motivation and Objective

- The solids loading exponent reflecting the effect of high solids concentration on just suspended speed (N_{js}) is contrasted with Zwietering's correlation.
- Effort was devoted to exploring the influence of scale up in coal slurry just-suspended agitation.
- The unsuspended solids fraction at stirrer speeds below just-suspended speed (N_{js}) was studied.

Experimental Methodology

Solids Loading Effect:

$$N_{js} = K * B^e$$

B: Solids Loading Fraction;

e: Solids Loading Exponent;

$e=0.13$ ($5 \leq B \leq 25$) for Zwietering's correlation.

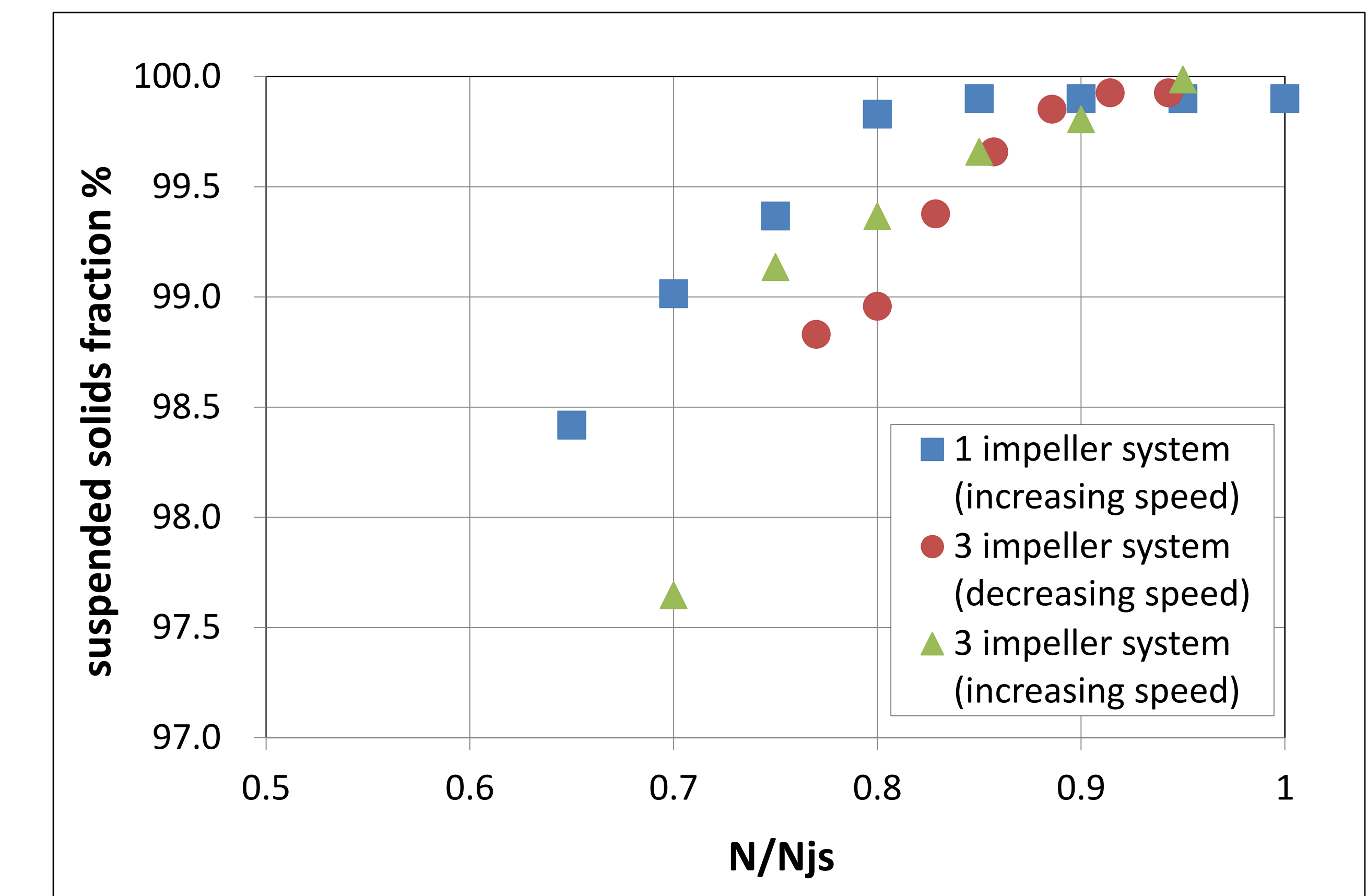
Scale Up Effect:

$$N_{js2} = N_{js1} * (D_1/D_2)^n$$

n: Scale Up Exponent;

D_1, D_2 : Impeller Diameter.

3. Unsuspended Solids Fraction



Conclusions

- The solids loading exponents of this study were higher than those found by Zwietering, and the higher the solids loading, the higher the exponent.
- The scale-up exponent that describes the effect of scale on the just-suspended speed depend on solids loading, with the scale-up exponent increasing with increasing solids loading.
- The suspended solids fraction did not fall below 98% until the stirrer speed was decreased to 70% of the just-suspended speed.

References

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