Universidad Autónoma Metropolitana
Casa abierta al tiempo Azcapotzalco

Analysis Of Turbulence In Tanks, By Modifying The Geometry And The Number Of Injectors

CBIA

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Introduction

This study proposes improving the mixing process in a horizontal cylindrical tank containing water and open to the atmosphere. The turbulence-generating plate will be installed at the center of the tank, and its angle will be varied in 0°-45° to determine the one that produces the highest average velocity and turbulence levels. Once the optimal angle is identified, the number of air ejector sets will be increased along the tank to find the best configuration that promotes flow throughout the system.

Methodology

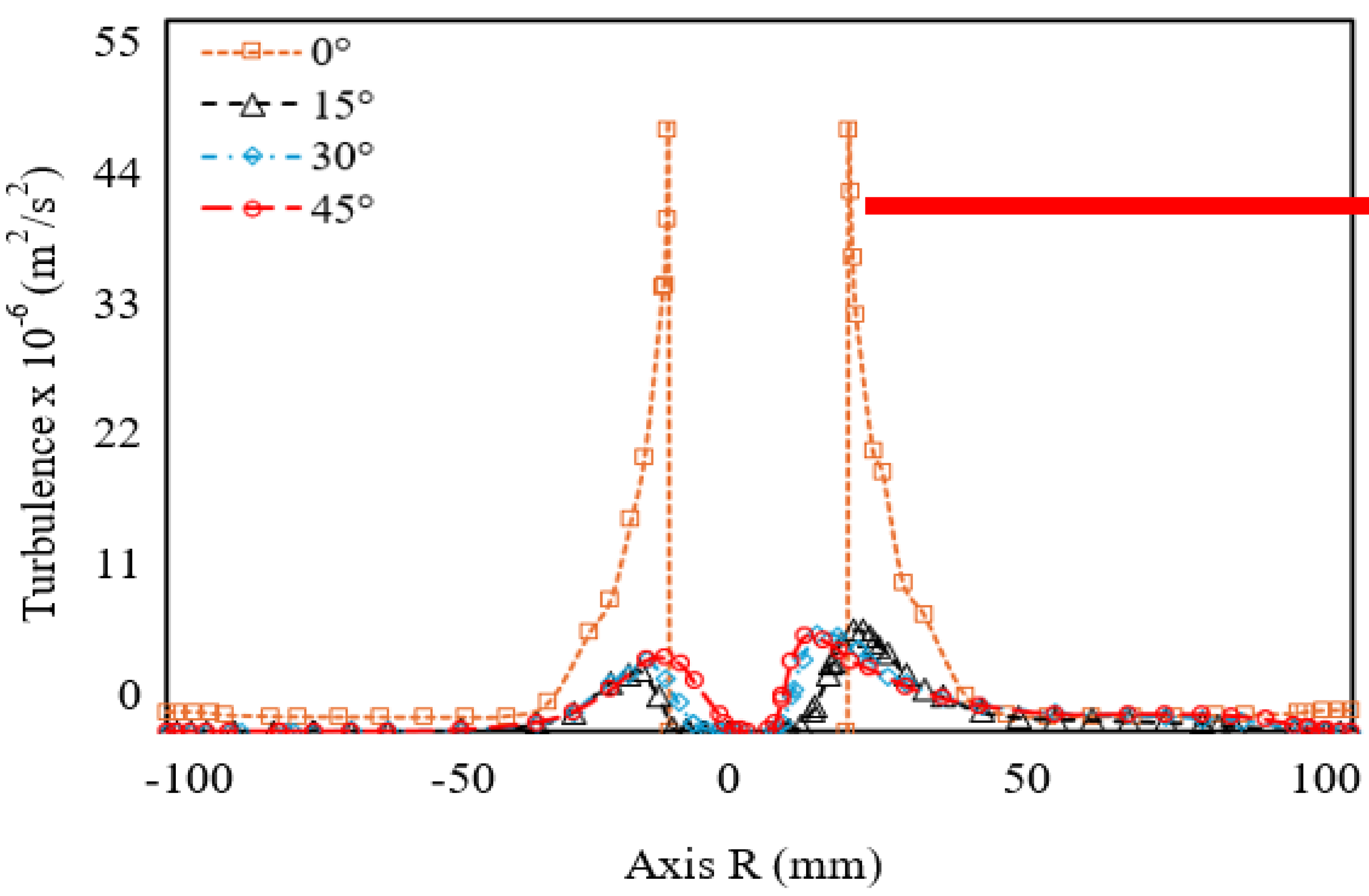
The proposed boundary conditions included a constant inlet of air velocity of 0.2 m/s. Regarding the outlet, it was modeled as being exposed to the atmosphere. A no-slip boundary condition was also applied to the rigid walls of the cylinder, the deflectors, and the turbulence-generating plate.

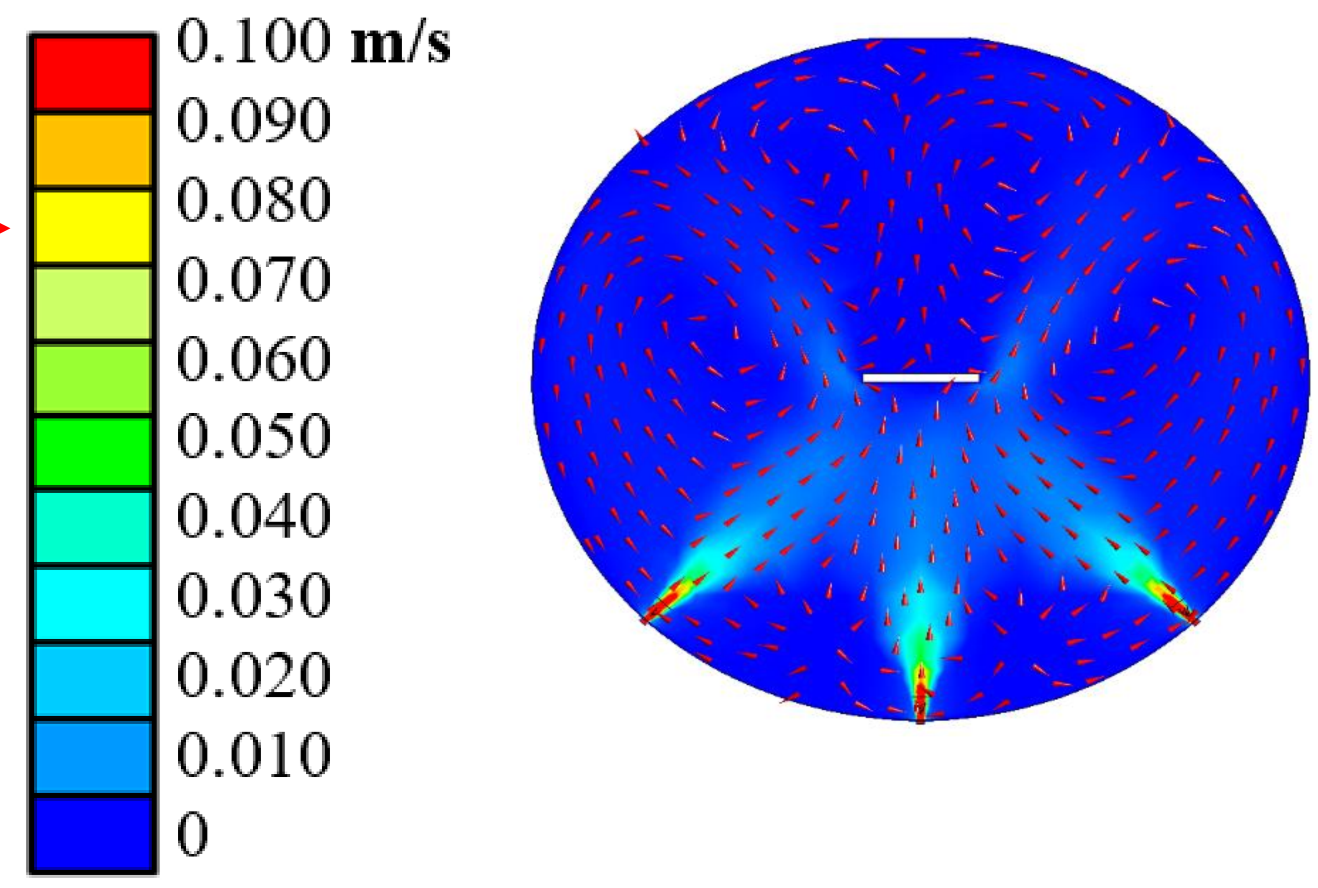
Results and discussion

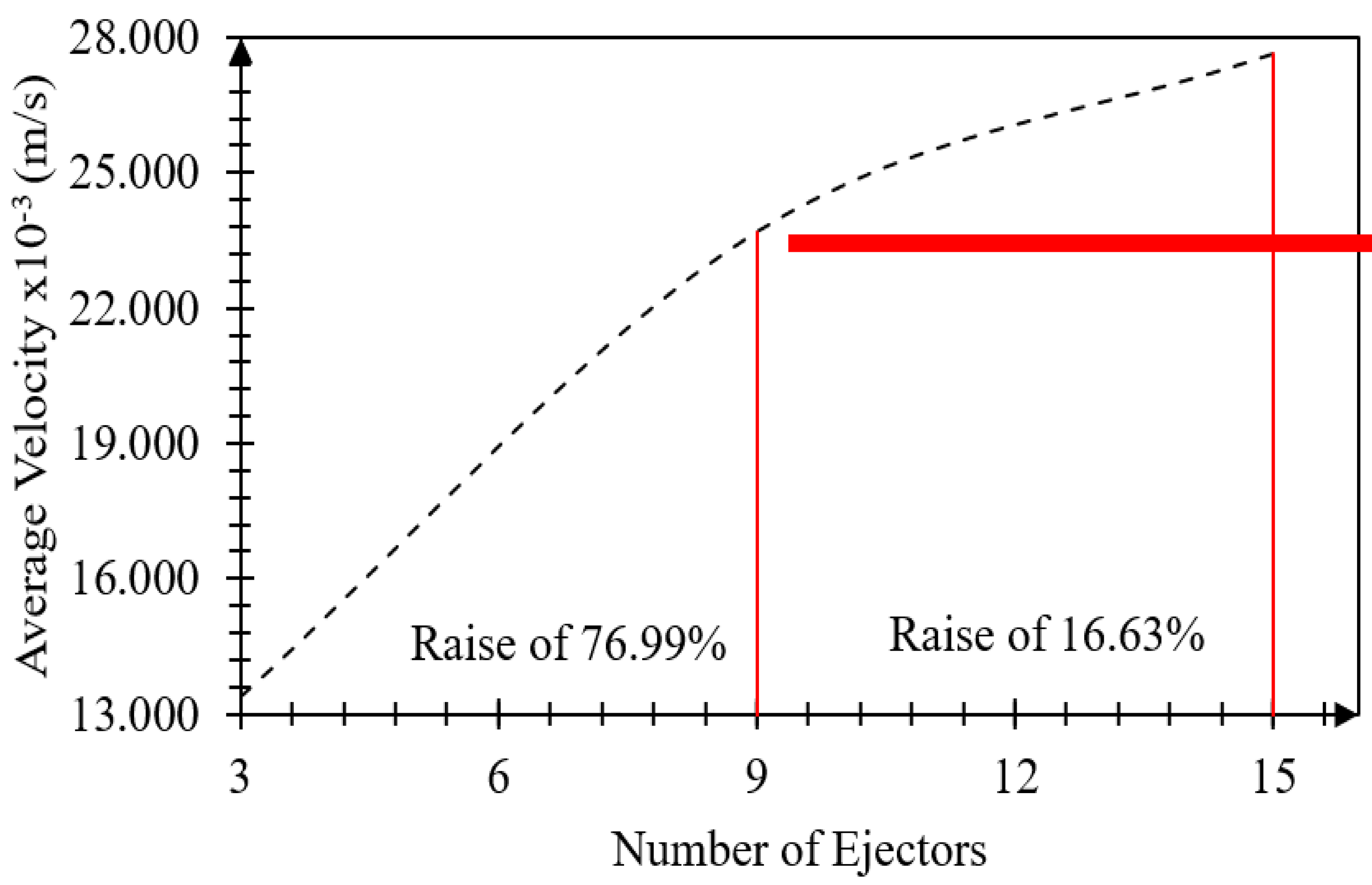
The 0° angle produced the highest turbulence in the central zone, with a peak of 53.446 x 10^{-6} m^2/s^2 and an average of 13.170 x 10^{-6} m^2/s^2, significantly outperforming the other angles, which showed much lower average values.
In the RZ plane, the average velocity increased from 0.01338 m/s (3 ejectors) to 0.023687 m/s (9 ejectors), a 76.99% rise. However, increasing to 15 ejectors yielded only a 16.63% gain (0.02762 m/s), suggesting that 9 ejectors is the optimal configuration for improving flow performance.

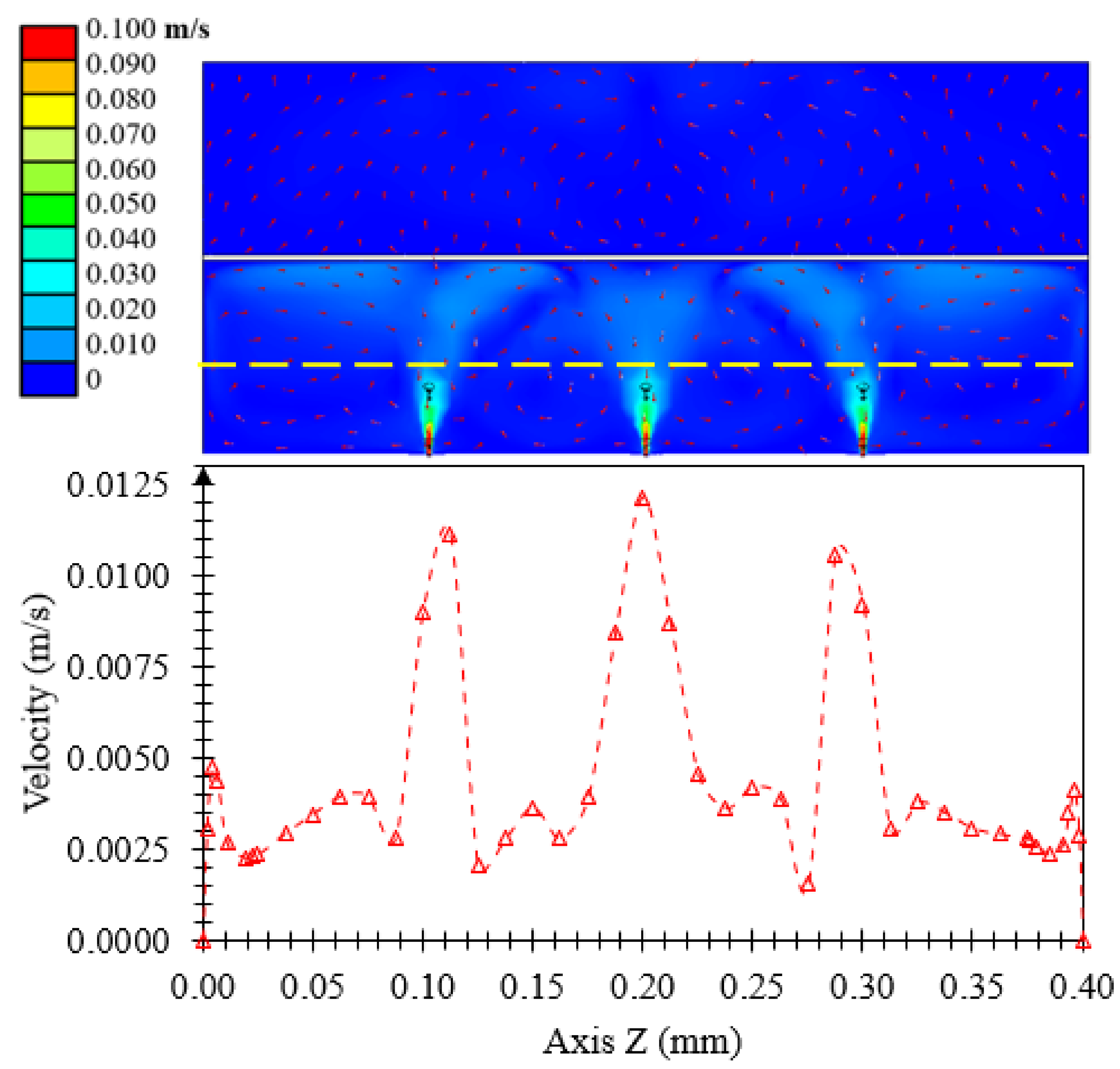
Conclusions

The study showed that a 0° plate angle produced the highest turbulence and velocity. Secondary vortices were generated that changed their position when the angle of the plate varied. Angles of 15°, 30°, and 45° resulted in lower performance, making higher inclinations less efficient for the given conditions.
Regarding air ejectors, 3 ejectors yielded the highest peak velocity (0.0221 m/s), but with limited flow distribution. Increasing to 9 and 15 ejectors improved overall flow, with diminishing returns beyond 9. Average velocity in the RZ plane confirmed this, indicating that 9 ejectors is an optimal balance between performance and efficiency.









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