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COMPUTATIONAL ANALYSIS OF FLOW AROUND CYLINDER AND DRAG FORCE: A WAY FOR STUDYING OF DOMAIN AND MODEL SETTINGS FOR SHIP OF COLLECTING MARINE WASTE

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ABSTRACT

In this work, cylinder model becomes simple object for making flow analysis and drag force. Computational modelling and analysis using CFD Ansys fluent 18. Work is carried out using four different scenarios to determine differences in drag force and flow around the cylinder. The four scenarios are the same conditions as the example, changes in material to water and air, changes in element size and changes in time step. Then the results of the four scenarios are compared with the results of experimental tests by previous researchers. This is done to describe how the flow around the cylinder and all its properties work and then apply it to more complex shape such as a ship.

MARINE WASTE IN INDONESIA

The largest contributors to plastic waste are China and Indonesia, in that order [1]. Condition of marine wastes in Indonesia as shown figures 1 and 2 show. The highest production of waste per day was in Java, especially Jakarta and Surabaya [2].

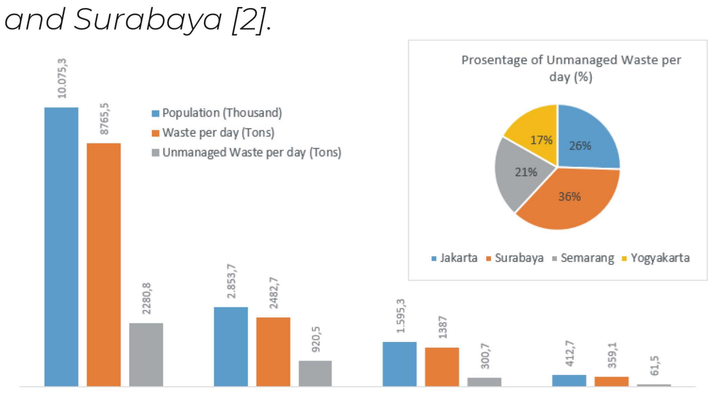

Fig 1. Waste in big cities in Indonesia

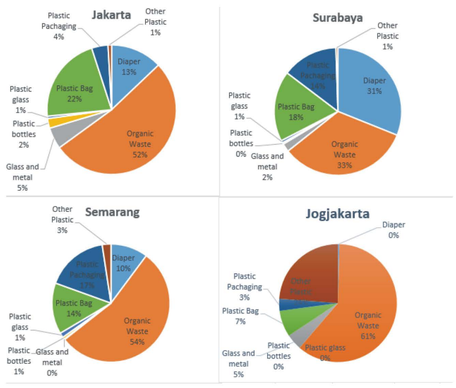

Fig 2. Types of waste

METHODOLOGY AND ANALYSIS

Variations of each scenario as well as the results of flow patterns as shown in Figures 6 to 11.

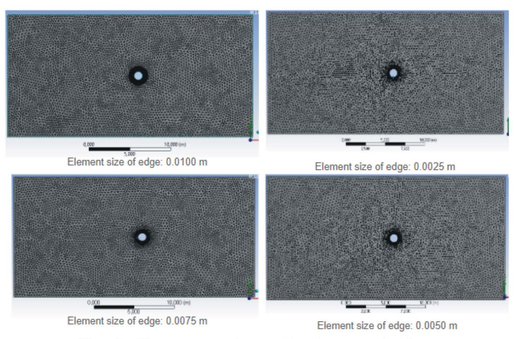

Fig 6. Element size of edge variations

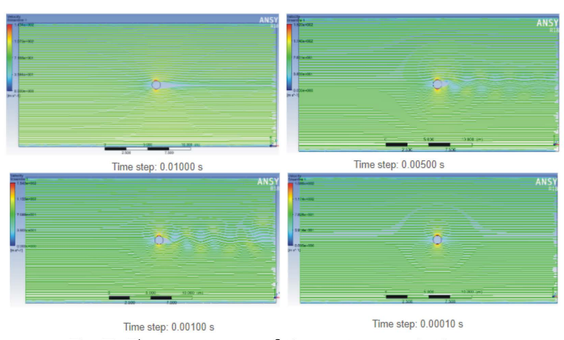

Fig 7. Flow pattern of time step variations

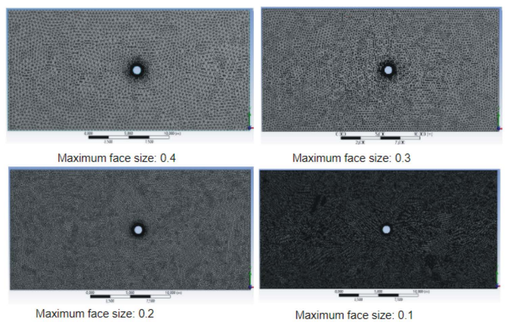

Fig 8. Maximum face size variations

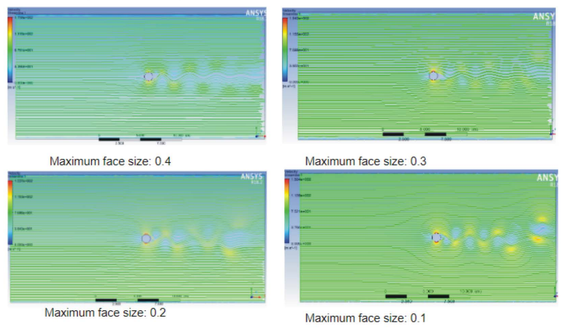

Fig 9. Flow pattern of maximum face size variations

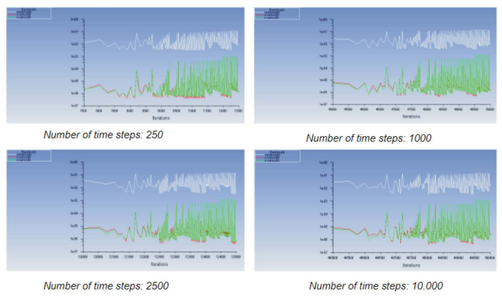

Fig 10. Number of time steps variations

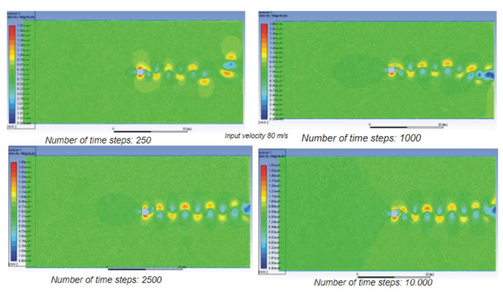

Fig 11 Flow pattern of number of time steps variations

MODELLING

The marine waste collection ship is designed to accommodate 25 tonnes of waste, the model of the ship is as shown in Figure 3. The tool used to collect marine waste that spreads out is net, while the tools used to raise the marine waste to the ship are conveyors, pictures of ship positions and nets such as in Figure 4. While the cylinder model used in this simulation is as shown in Figure 5.

Fig 3. Ship model

Fig 4. Ship and net position

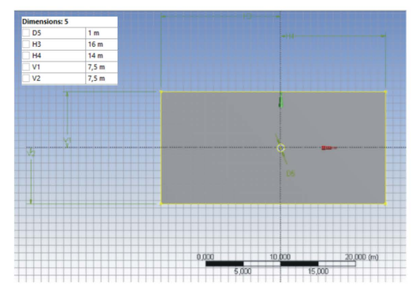

Fig 5. Cylinder geometry

RESULT

The results obtained from several simulation scenarios were compared with the previous research [3]. The drag coefficient ratio for variation of fluid types is shown in Figure 12, while the drag coefficient ratio for variation in Reynolds number (Rn) is shown in Figure 13.

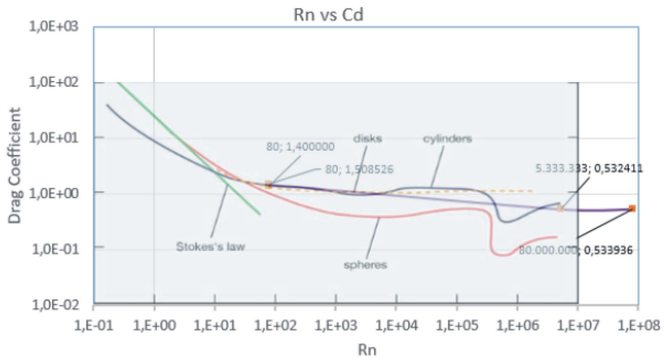

Fig 12. Simulation result (purple) compare with previous research in fluids variation

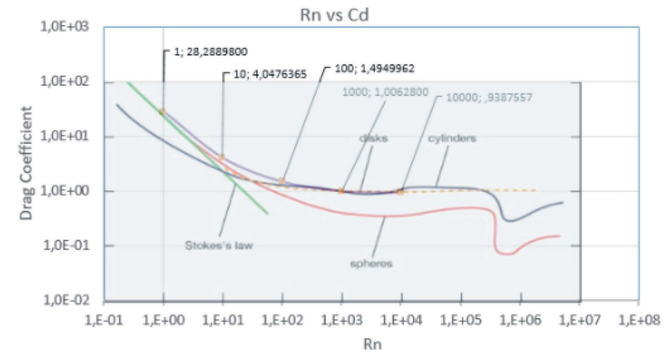

Fig 13. Simulation result (purple) compare with previous research in Rn variation

REFERENCES

[1] J. R. Jambeck et al, 2015, pp. 1655–1734 [2] Work Bank Group, 2018, pp. 1–49 [3] T. Baracu and S.G. Benescu, 2011.