Pengurangan hambatan kapal modelmonohull katamaran dan trimaran dengan pelekatan biopolimermonopterus albus (lendir belut) pada dinding kapal = Resistance reduction of monohull catamaran and trimaran ship models through attachment of monopterus albus biopolymer on the ship hulls

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Abstrak

Usaha para peneliti untuk menciptakan alat transportasi air (kapal) yang hemat energi terus dilakukan hingga saat ini. Modifikasi geometri, dimensi dan jumlah lambung merupakan suatu hal yang penting dalam usaha pengurangan hambatan kapal. Penggunaan Jenis kapal berlambung banyak katamaran dan trimaran mencapai angka 40% dari total kapal yang berlayar. Hambatan total kapal terdiri atas hambatan gesek dan hambatan sisa. Hambatan gesek merupakan fungsi dari geometris, perubahan tekanan, kekasaran permukaan dan coating pada permukaan lambung. Hambatan sisa fungsi dari gaya seret gelombang yang terbentuk oleh masing-masing lambung kapal. Dengan kemajuan ilmu material, diciptakan berbagai macam cat yang dapat berfungsi sebagai pelindung dinding kapal dan sebagai pengurang koefisien gesek. Kulit ikan belut yang mengandung lendir merupakan biopolimer yang ramah lingkungan dan tidak beracun.
Tujuan dari penelitian ini yaitu mengetahui efek variasi pelekatan biopolimer kulit belut (Monopterus Albus) pada lambung model kapal monohull, katamaran asimetris dan trimaran asimetris terhadap hambatan total model kapal dengan variasi bilangan Froude. Model kapal monohull, katamaran dan trimaran dengan pendekatan displacement yang sama dan diberikan variasi posisi pelekatan kulit belut pada lambung model kapal ditarik dengan variasi kecepatan pada kolam percobaan. Variasi sarat dan trim digunakan pada percobaan ini.
Pengukuran tegangan tali pada kecepatan kapal konstan (tercapainya terminal velocity) dilakukan dengan load cell transducer yang terhubung ke data akusisi. Percobaan dilakukan dengan teliti dan dilakukan pengulangan secepat mungkin untuk menghindari degradasi biopolimer lendir belut. Percobaan dilakukan pada air tawar dan perubahan temperatur seminimal mungkin (dijaga konstan). Hasil menunjukkan pelekatan biopolimer pada monohull menghasilkan drag reduction sebesar 8 % pada bilangan Re = 20.000. Pada kapal katamaran asimetris, S/L = 0,2 terjadi drag reduction sebesar 6 % pada bilangan Froude = 0,45. Pada kapal trimaran asimetris, S/L = 0,2 dan R/L = 0,0 terjadi drag reduction sebesar 10.4 % pada bilangan Froude = 0,35. Dimungkinkan efek biopolymer mempengaruhi distribusi kecepatan pada lapisan terluar (outer layer) sehingga laju kecepatan kapal bertambah.
.....Up to present time researchers are still continuously attempting to create energy saving water transportation vehicles (ships). Geometry, dimensions and number of hulls modification is an important effort to reduce the resistance of ship. The use of multi-hull ships such as catamaran and trimaran has reached 40% of total sailing ships. Total ship resistance consists of frictional resistance and residual resistance. Frictional resistance is the function of geometrics, pressure changes, surface roughness and coating of the hull surface. Residual resistance is the function of wave dragging force created by individual hull. With the advancement of material science various kind of paints have been created that could act as hull protection and as frictional coefficient reducer. Eel skin contents mucus that is environmentally friendly

and non-toxic.

The objective of the research is to investigate the effects of Monopterus Albus biopolymer attachment variations on monohull, asymmetric catamaran, and asymmetric trimaran model hulls to ship model total resistance with variation of Froude numbers. Monohull, catamaran, and trimaran ship models with same displacement approach were attached with eel skin at various positions on their hulls, the ship models were towed with various speeds on the test basin. Variation of drafts and trims were applied on the experiment. The tensions of the towing string at constant ship speed (at the terminal velocity) were measured using load cell transducer which was connected to data acquisition. The experiment was conducted very carefully and repetitions were carried out very quickly in order to avoid the degradation of Monopterus Albus biopolymer. The experiment was carried out on fresh water with very little changes of temperatures (kept constant).

The results showed the attachment of biopolymer on monohull produced 8% of drag reduction at Re number = 20.000. On asymmetric catamaran with S/L = 0.2 produced 6% drag reduction at Fr = 0.45. On asymmetric trimaran with S/L = 0.2, and R/L = 0.0 produced 10.4% drag reduction at Fr = 0.35. These results are due to the effect of biopolymer in distributing the velocity at the outer layers that increase the velocity of the ships.