INTISARI

Umumnya, pelindung pantai dari *tsunami* tidak tersedia secara alami. Di beberapa tempat di mana *runup tsunami* perlu direduksi dan pelindung pantai alami tidak tersedia, dibuat pelindung buatan dengan membangun tembok laut dan/atau pemecah gelombang. Alternatif lain solusi dapat mamakai hutan bakau (*rhizophora forest*), bagian dari hutan *mangrove*, sebagai pelindung alami pantai dengan biaya relatif lebih rendah, ramah lingkungan dan dapat memberi keuntungan komersial.

Simulasi model fisik dilakukan di laboratorium dengan 3 variasi kemiringan pantai 5°, 10° dan 15° serta 4 variasi model hutan bakau (*RFMs, Rhizoprora Forest Models*). Semua model hutan dibuat dari bahan kawat besi dengan spesifikasi tinggi rerata pohon 10 cm, kerapatan hutan 1,25% dan 5%, dan juga ketebalan hutan 50 cm dan 100 cm. Skala model adalah 1:50 tanpa distorsi. Simulasi dilakukan pada kedalaman air 4 cm dan 8 cm serta 12 variasi tinggi gelombang yang melimpas melebihi dan tidak melebihi tinggi rerata pohon bakau. Data analisis berdasar pada teori umum gelombang, teori gelombang solitar, metoda regresi logaritmik dan metoda iterasi.

Pada pantai dengan suatu kemiringan tertentu dan berpelindung hutan bakau, jarak horisontal dan vertikal *runup tsunami* dan reduksi jarak tersebut dipengaruhi oleh karakteristik hutan bakau, kemiringan pantai dan karakteristik *tsunami*. Hutan bakau, baik alami maupun semi-alami, bermanfaat untuk mereduksi tinggi, energi dan jarak *runup tsunami*. Kuantitas reduksi bergantung pada kerapatan hidraulik dan dimensi hidraulik hutan sebagai respon karakteristik hutan (tinggi rerata pohon, kerapatan dan ketebalan) terhadap karakteristik *tsunami* (kedalaman air, tinggi dan panjang). Hutan bakau dengan kerapatan 5%, tinggi 5 m dan tebal 50 m akan memproduksi kerapatan hidraulik 5%, tinggi hidraulik 1,00 dan tebal hidraulik 0,05 ketika *tsunami* dengan tinggi 2,22 m dan panjang 1 km menjalar pada kedalaman perairan pantai 2 m. Kuantitas reduksi tesebut akan sebesar 52% tinggi *tsunami*, 38% energi *tsunami*, juga 14%, 19% dan 22% jarak *runup tsunami* di atas muka air tenang (*Still Water Level*) berurutan untuk kemiringan pantai 5°, 10° dan 15°.

Kata kunci: *tsunami*, perlindungan pantai, hutan bakau, *rhizophora, mangrove*

ABSTRACT

Generally, beach is not protected from tsunami by nature. An artificial protection could be made on the beach where the tsunami runup should be reduced and natural protection is not exist, e.g. seawall and/or breakwater. One of the other solution is to use a rhizophora forest (a part of mangrove forest) as a quasi-natural beach protection, which is relatively low budget, environmental kinds, and available commercial benefits.

A laboratory experiment was conducted using physical models with 3 variations of beach slopes (5°, 10°, and 15°) and 4 variations of RFMs (Rhizoprora Forest Models). All of RFMs were made from a steel-wire with specific properties, i.e. 10 cm of tree height, 1.25%, and 5% of forest density, besides 50 cm and 100 cm of forest thickness. Model scale was 1:50 without distortion. When models were simulated, 4 cm and 8 cm of water depth and 12 variations of wave height were performed that propagated over or not over the average tree height of the forest. The data were analyzed based on the general wave theory, solitary wave theory, logarithmic regression method, and iteration method.

At the beach with an uniform beach slope and protected by the rhizophora forest, the horizontal and vertical distances of tsunami runup and their reduction depends on forest characteristics, beach slope, and tsunami characteristics. The natural/quasi-natural existing rhizophora forests have advantages to reduce tsunami height, energy, and runup distance. That reduction depends on hydraulic density and hydraulic dimension of the forest as a typical response of forest characteristics (average tree height, density, and thickness) to tsunami characteristics (water depth, wave height, and wave length). Rhizophora forest with 5% density, 5 m height, and 50 m thick will produce 5% of hydraulic density, 1.00 of hydraulic depth, and 0.05 of hydraulic thickness, while tsunami with 2.22 m height and 1 km length propagate on the beach at 2 m depth is being damped. Reduction values will be 52% of wave height, 38% of wave energy, also 14%, 19%, and 22% of runup distances above Still Water Level on 5°, 10°, and 15° beach slopes respectively.

Keywords: *tsunami, beach protection, rhizophora,mangrove, forest*