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PROPERTIES AND LIQUEFACTION RISK ON BULK CARGO CARRYING BUKIT GOH, KUANTAN BAUXITE; IN ACCORDANCE WITH IMSBC CODE

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ABSTRACT: Bauxite is a raw material used in the production of alumina and, subsequently, aluminium. Like many metals, world demand for aluminium, and therefore bauxite, has grown substantially over the past 10 years in response to economic growth in emerging Asian economies. Bauxite is a relatively soft ore with a distinctive reddish brown colour. Bauxite ore from Malaysia exported to manufacturing country such as China to be processed into aluminium. Basic properties of bauxite are determined for exporting purpose in which several international specifications need to be followed while handling bauxite in order to ensure those raw materials are passing the standard to be imported. Laboratory test had been done to bauxite samples from Bukit Goh in Kuantan to determine its basic and morphological properties. It is found out that moisture content of raw Bukit Goh bauxite is higher compared to processed bauxite where it has the average of 24.33% over 7.16% only on the processed bauxite sample. For particle distribution, it shows that the processed bauxite has less fine particle compared to raw samples with the average of 16.60% compared to raw with 38.50%. Result from FESEM test proves that the lesser fine particle attached to the processed bauxite ore. Referring to the IMSBC Code, it can be stated that raw bauxite samples from Bukit Goh does not pass the standard. This is due to the presence of bulky fine particles which tend to absorb water more than granular particles that may lead to liquefaction to occur. Liquefaction during cargo transportation is high risk especially when there are strong current at the sea. In order to ensure the bauxite is passing the standard, beneficiation process must take place where it include washing, wet screening and mechanical or manual sorting.

Keywords: International Maritime Solid Bulk Cargoes (IMSBC) Code, Bauxite, Liquefaction

1. INTRODUCTION

Cargo liquefaction has been an arising issue since it is the major reason for numerous bulk carriers' capsizes. Many solutions have been adopted by researchers and seafarers to avoid these incidents which can be divided into experimental tests and numerical simulations [6] , [1]. The main cause of the problem is excess pore water pressure within the bulk cargo. The presence of unmanageable pore water pressure will weaken the microstructure of the soft soil particles, and it can make the unloading creep damage of soft soil extremely strong and even cause liquefaction [8]. The scenario is similar to liquefaction in solid bulk cargo. The ship's motion and the engine vibration during passage may cause particle rearrangement and compaction [3]. The gaps between the particles become smaller in the process, with the corresponding pore pressure progressively increasing [2]. As a result, the water holding ability of particles and the friction coefficient between cargoes decreases. In particular, the water in the interstellar spaces comes together to form a liquid layer that allows the cargo above to move relative to the cargo below – as if the two layers were part of a liquid and hence the term 'liquefaction'. Such a transition during ocean carriage can cause a sudden loss of stability of the carrying vessel. In the last ten years, more than ten ships capsized and sank due to a loss of hull stability attributed to the cargo liquefaction [4]. In addition, the problem of water pollution was widely reported by mainstream and social media. Bauxite is the major alumina (Al2O3) bearing ore used in the aluminum manufacturing industries. The bauxite containing less than 50% Al2O3 is called low-grade bauxite ore which is commonly used for the alumina-based abrasives and refractories productions. The alumina-silica and alumina-ferrite complexes are the foremost impurities present in the low-grade bauxite [9]. Aluminium is the most abundant metal in the crust of the earth and also can be recycled repeatedly while maintaining its quality, so it is an