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Coral Bay Shore Zones Tar Ball Distribution

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Abstract

Oil spill and wastewater discharge to the marine waters contribute to the tar ball formation after the residue washout to the sandy beaches. The oil degrades over time through dynamic changes of the hydrocarbon compounds once exposed to the environmental factors which influences the fate and transport of the oil residue. Tar balls collected from Coral Bay shore zone which is used for recreational activities are 100 gm/strip with up to 6 cm in diameter. The collected tar ball was analyzed using FID gas chromatography after 50% n-hexane and dichloromethane extraction and fingerprint to the diesel and crude oils. The tar ball sample contains beta-pregnane (22-29 %) and dotriacontane (52-68 %) which accumulate over long time from crude oil spills in the Strait of Malacca.

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Keywords: Tar ball; hydrocarbons; marine waters

1. Introduction

This paper investigates the hydrocarbons residues spillage that forms the tar ball deposit on the shore zones at the Coral Bay located at Pangkor Island. The hydrocarbon fate and transport drives by the biodegradation and photolysis, and mixing accelerated by the environmental factors of wind speed and currents. The oil slick washed off to the shore zones coagulated with sandy particles and debris forming the ubiquitous tar ball from resistant hydrocarbons compounds.

Nomenclature

χ	Particle dispersion, dimensionless
u	Speed of fluids (cm/s)
T	Time (min)
L	Langmuir Cell dimension (m)

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1.1. Oil pollution

Hydrocarbon resources had been drilled and utilized by mankind from the nineteenth century. The discovery leads to the utilization of fossil fuel to assist human activities. Global fuel consumption of 1.0 million bbl/d was recorded for 2013 but the consumption was decline in 2014 [1]. The fuel products are utilized in motor vehicles, power generators and jet fuels. The massive production and uses of fuels create oil pollution to the environment. Typical crude oil contains 58% saturates, 28.6% aromatics, and 14.2% polar compounds. CH_2 is found dominance the saturated molecules components. The oil spill or oily residue is a complex combination of refined products, additives, silica, metals and heavy tars.

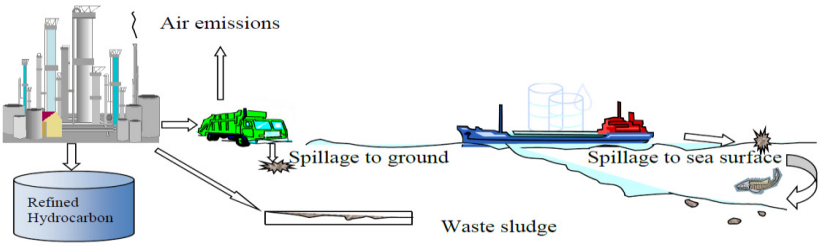

Fig. 1. Hydrocarbon spillage and migration.

Critical environmental damage occurs in the case of crude oil spillage, from process stream or during transport as in Figure 1. The incident is caused by human error or system error during operation or natural disaster such as heavy storm and earth quake. Table 1 shows the normal release of petroleum products to the environment.

Table 1. Hydrocarbon release into the environment.

Sources	Cases
Tankers	Oil water mixtures remaining in tanks are discharges into the environment
Tankers accidents	structural failure, followed by grounding and collisions
Dry docking	Tankers must be cleaned during maintenance and inspection
Terminal operations	Losses from spillage in transfer
Bilges and bunkering	Bilge water and leaks from bunkers
The atmosphere	Internal combustion engines and power plants
Municipal and industrial wastes	Sewage-treatment plants and industrial wastewater
Urban runoff	Oil heating system, automobiles, and service stations
Point sources	Power plants, military bases, and marinas
Storage facilities	Gasoline and jet fuel tanks, military fuel depots

Major oil spill incidents create expensive lesson learned as shown by the former cases:

- *The Florida* spill of nearly 700,000 L of oil resulted in 15 cm deep of oil in sediment. The oil spill is remains in the same condition in 1976, after 7 years of the cases as found by the scientist.
- Estimated 200,000 tonnes fuel oil spill from *Prestige* caused more than 200 million Euros been spent for beach cleaning so far.
- Exxon spent more than $2 billion cleaning up 34,000 tonnes of crude oil spilled in 1989 Exxon Valdez disaster in Alaska.
- Estimated damage of 1999 disaster off the French coast from the tanker *Erika* spilling of 15,000 tonnes of fuel oil, had cost as high as $860 million.
- Brazil state oil Petrobras had appeal a $180 million court award to fisherman following a major oil spill in Rio De Janeiro's scenic bay in Jan 2002.

Strait of Melaka is one of the important marine water for navigation in the South East Asia region. According to DOE Environmental Quality Reports, oil and grease is the highest pollutant to Malaysians marine water. The Environmental Quality Reports 1995 to 1997 the oil and grease contributed to 60 to 85 % compare to the other marine water pollutants [2, 3, 4]. The