ISSN 0794—9618

VOLUME 2 1992

TROPICAL JOURNAL OF APPLIED SCIENCES

SPONSORED BY THE UNIVERSITY OF CALABAR AND THE UNIVERSITY OF UYO

Tropical Journal of Applied Sciences, 2: 52 - 55 (1992)

THE LEVELS OF STRANDED PELAGIC TAR RESIDUES ON IBENO BEACH, NIGERIA

ULO K. ENYENIHI, FRANCIS E. ASUQUO and EFFIOM E. ANTIA
Institute of Oceanography, University of Calabar, P.M.B. 1115, Calabar, Nigeria.

ABSTRACT

Several sampling trips since 1984 to the present have been undertaken and tar residues collected and quantified from twenty-two sites along Ibeno beach on the South Eastern Nigeria. Initially, little or no tar were observed in 1984. The mean levels of tar, 1.06 g/m^2 (range 0.40 - 2.84g/m^2) and 0.55g/m^2 (range 0.01 - 3.16 g/m^2) per beach transect were collected for 1985 and 1986 respectively. A general decline in the amount of tar from March to October was observed in 1986. Throughout the study period, large amounts of tar residues were collected only in the early months of the year. The influence of beach topography and its contribution to the low level of tar ball is discussed.

INTRODUCTION

There is increasing global concern towards the pollution of the marine environment by crude oil and its associated products. Many quantitative investigations of tar stranded on the beach or floating on the water surface have been carried out especially in the Mediterranean and Caribean regions. The present report contains the research results on tar ball sampling on the beaches of the South Eastern Nigeria.

Petroleum pollution of the marine environment can be easily assessed by the amount of stranded tar balls on the beach (Golik 1982, Enyenihi and Antia 1985, Robertson Smith et al, 1985, Golik, 1985). Tar balls are the final weathering product of crude or refined oil accidenially released into the marine environment through anthropogenic or natural sources. The processes governing the formation of tar balls in water from the time of accidental release to their final deposition on the beach have been vividly described by several authors (Pilpel 1968, Goldberg 1975, Clarke et al 1977). Beaching is described as the most dominant factor during the disposal of the weathered oil in water. It is the final and most probable destination of the floating tar balls (Pilpel, 1968). This project was undertaken to assess and evaluate the extent to which petroleum hydrocarbon pollution has affected the defined area and to provide data needed for the successful planning and management of the resources of the environment.

The Area Studied

The South-Eastern Region of the Nigerian coastline is congested with the exploratory and exploitative activities of many oil companies. Fronting the Ibeno beach is the area of operation of the Mobil Oil Company with many oil rigs and wells located all over the coastal environment (Fig. 1). The beach is mesotidal (2 - 4 m) and sandy with

low gradient not exceeding 10° at the steepest point before the new berm edge. It is principally fine grained and well sorted (Enyenihi and Antia, 1985).

Materials and Methods

Twenty-two stations were chosen inequidistant based on the geomorphological features on the beach. Tar sampling at each of the chosen site was done by marking out a 1-metre strip or transect (running across the beach) from the water line to the backshore. All visible tar on the surface and upper 2 cm of the sandy beach were collected and transported to the laboratory. The preliminary work up and quantification of samples were carried out as described in Intergovernmental Oceanographic (IOC) Manual Number 13 (1984). Some basic oceanographic parameters measured included wave period and longshore current velocity using a stop watch, breaker height with the aid of a calibrated staff, breaker wave type was determined by observing different sets of breakers and wind spread and direction measured using hand anenometer. Tar sampling was done at or near ebb tide during each sampling trip.

Results and Discussion

Enyenihi and Antia (1985) had discussed elaborately the influence of littoral environmental factors on the amount of tar deposited on the Ibeno beach. They observed that for the 2.5 km stretch monitored there was little contamination ofthe beach by tar. Data on the state of the beach in 1986 is preserved in Table 1 and the yearly analysis of tar levels since the inception of these project is shown in Fig. 2. The highest amount of tar was recorded in April (1.73 g/m^2/month). Gradual diminution in tar levels was observed from March to October corresponding to the change from dry to wet season. While some stations had very little or no tar balls, most of the stations had quantifiable tar residues. The months March and April had more tar balls than the other months. This is attributed to the dry and windy weather prevalent during the transitional period (from dry to wet season) which might have aided the dominating spilling breaker waves to transport the tar balls to the upper shore (beach).

Tar levels were generally lower in 1986 than 1985. Bar plots of the monthly average concentrations of tar during the period showed an overall downward trend except June 1985 which gave the highest tar value (2.67g/m^2/month). This high value is caused by occasional storm tide that enhances the transportation of tar beyond the new berm edge into the backshore. An average wind velocity of 4.5m/sec. (range 1.0 - 8.5 m/sec.) being mostly onshore and a mean longshore current velocity of 0.26 m/sec. East (range 0.05 - 0.55 m/sec.) were also recorded.

The topography of the Ibeno beach has greatly influenced the amount of tar deposited on the beach. The backshore consist principally of two portions - the intertidal portion up to the new berm edge and a sandy portion sparsely covered by vegetation and sloping to the old berm edge. The latter though slightly inhabited by weeds, tar balls can be seen clearly. Where there was a steep gradient (25 - 45°) little or no tar was present and it usually end up with a small pool before the old berm edge. In the absence of the pool, few tar were found ac-

Table 1

Results on Tar balls along Ibeno beach

Months	1985	1986
01	0.0	N.S
02	0.0	N.S
03	0.99±0.5	1.22±2.89
04	0.30±0.46	1.73±4.29
05	0.07±0.11	0.54±1.17
06	2.67±3.10	0.48±0.61
07	0.49±0.64	0.11±0.11
08	0.63±0.65	0.14±0.21
09	N.S	0.07±0.31
10	N.S	0.03±0.08
11	N.S	N.S
12	N.S	N.S

Mean of 22 stations; units in g/m^2/month
N.S - no sampling

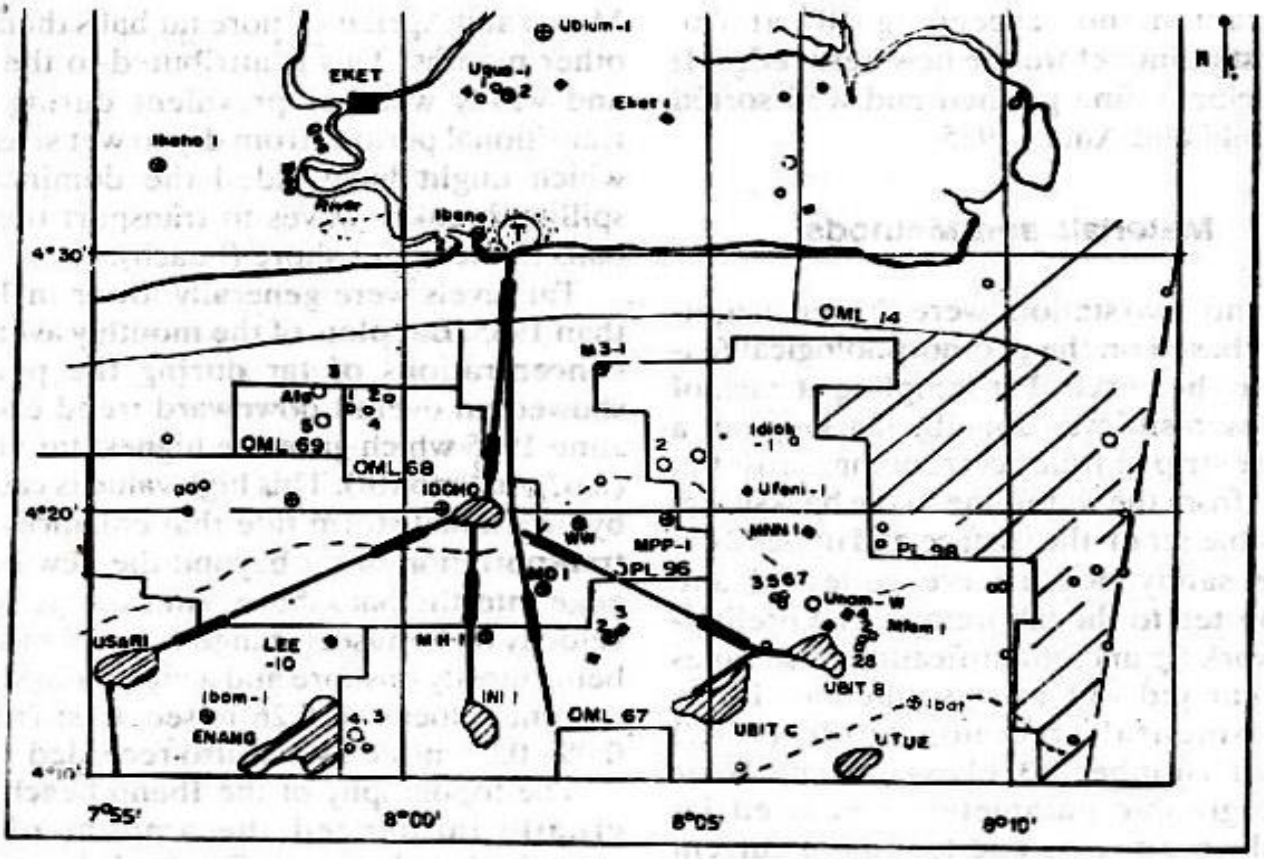

Fig 1 Part of the Cross River State coastline showing study site and offshore petroleum installations (Adapted from Enyenihi and Antia 1985)

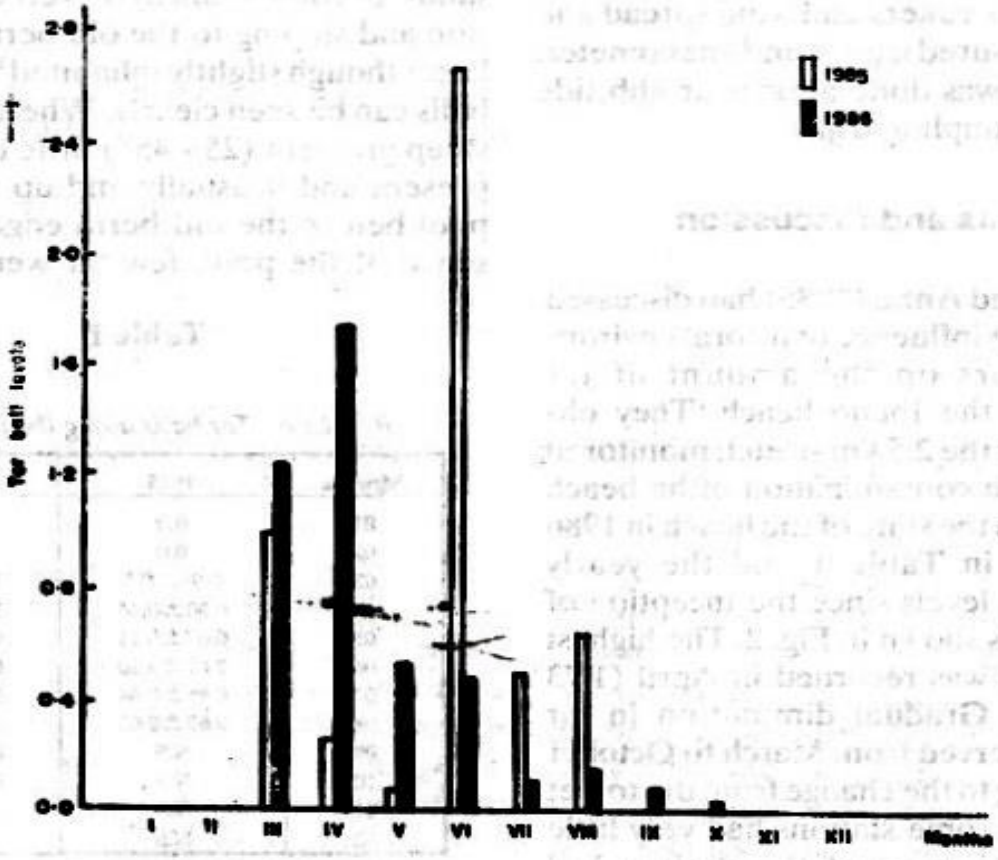

Fig. 2 Monthly mean of Tar Ball in 1985 and 1986. Values in gm / m^2 / month.

cumulating in a narrow horizontal strip about 1.5 metres wide close to the old berm edge. The existence of the pool and the slope have contributed to the low tar since the former can wash away any tar that rolled into it back to the ocean and the latter can hardly retain tar that is transported to it.

Although the amount of tar reported in this study is low (1.06 g/m^2), it is needful to carry out the determination of petroleum hydrocarbon levels in the water and sediment. Such findings will provide the much needed data required for effective management and utilisation of the water resources.

ACKNOWLEDGEMENT

The authors wish to appreciate the able assistance of Mr. Usen Umana during the field trips and laboratory analysis.

REFERENCES

Clarke, R. C. (Jr.) and Macleod, W. D. (Jr.) (1977). Inputs, transport mechanisms and observed concentrations of petroleum in the marine environment. In: Effect of petroleum on Arctic and Sub-Arctic marine environments and organisms. Vol. 1, Nature and Fate of petroleum, (eds. D. C. Marlins), Academic Press, New York, pp.102 - 134.

Enyenihi, U. K. and Antia, E. E. (1985). Tar balls as indicators of crude petroleum pollution on the beaches of Cross River State, Nigeria, First workshop of participants in the joint FAO-IOC-WHO-IAEA-UNEP project on monitoring of pollution in the marine environment of the West and Central African Region, IOC workshop report Number 41, Annex V. 9, pp. 1 - 8.

Goldberg, E. D. (1975). Marine pollution. In: Chemical Oceanography, (eds. Rilley, J. P. and Skirro, G.), Vol.3, pp. 53 - 59.

Golik, A. (1982). The distribution and behaviour of tar balls along the Israeli Coast, Estuar, Coast Shelf Sci., 15, 267 - 276.

Golik, A. (1985). Accumulation of tar balls on the beach, Israeli Oceanography Limnol. Res., Haifa, H3/85, p. 10.

IOC (1984). Manual for monitoring of oil and dissolved/dispersed petroleum hydrocarbons in the marine waters and on beaches. IOC Manuals and Guides,Number 13, p. 14.

Pilpel, N. (1968) Endeavour, 27, p. 11.

Robertson-Smith, S. and Knap, A. H. (1985). Significant decrease in the amount of tar stranding on Bermuda, Mar. Pollution Bulletin, 16, 19 - 21.