%RSD for these samples is <1, except for GXR-3, where it is 1.1. The limit of detection calculated as three times the standard deviation of the blank was about 0.027 mg per kg, indicating that the sensitivity of the method stated is satisfactory for the measurement of iodine concentration in the soil and sediment. For GXR-5, two values have been reported in the literature. From our six repeat measurements in which the experimental conditions were optimized for the sample preparation as well as for the instrument, we report a consistent value of 20.749 ppm, which has been supported by iodine concentration determination using XRF. TMAH being a strong base prevents iodine losses through volatilization, as it forms tetra methyl ammonium iodate salt in the reaction mixture. It has been seen that high matrix loading of TMAH may produce carbon black when oxidized in the plasma. To prevent any such blocking, diluted samples having 1% TMAH are recommended for analysis[17]. When carrying out extraction of iodine with 1% TMAH, yields obtained were less compared to certified values. Increasing the overall concentration of TMAH to 2% in the present method resulted in better extraction yields. During optimization of the procedure, rhodium was also used as internal standard for analyses over ICP–MS, as it was found to be at negligible levels in the samples investigated and is a mono-isotopic element like antimony. It is observed that use of antimony as an internal standard gave better results, which are much closer to the recommended values. The stability period of the prepared alkaline extract of soil samples since the day of preparation, was also observed under cold conditions (3°C). It was found that the extract can be stored for a week from the day of preparation, after which the concentrations are susceptible to variation. Hence immediate analysis is preferred.

This study provides an improved method for the extraction and determination, iodine in soil using TMAH and ICP–MS. The measured values are in good agreement with the certified values and %RSD is <1%. The concentration of iodine determined in soil standards was significantly close to the certified values, wherever available for comparison. For the geochemical exploration samples and marine sediments, for which certified values are not available, the concentration of iodine has been proposed supported by XRF determination for some selected samples. The method involves a simplified procedure for rapid analyses of iodine concentration in soils and can be reliably applied to a large number of samples, especially in oil-exploration studies.

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Road deposited sediment characteristics of Middle Brahmaputra Plain, India

Pollution of the environment by anthropogenic activities is a ubiquitous phenomenon today in the entire globe. Preventing pollution and assessment of the environmental quality has become an important challenge to the scientific community. In the fast-moving world, vehicular mode of transport is growing at a rapid pace and thus the vehicular contribution to pollution.

Road deposited sediment (RDS) is a good indicator of environmental quality of an area, especially pollution that originates from vehicular source. RDS originating from the interaction of solid, liquid and gaseous materials produced from different sources[1] has become an increasingly important environmental sampling medium for assessing anthropogenic metal levels[2,3]. The ubiquitous nature of RDS, it easy sampling, strong association with automobile emission and relationship with non-point pollution source makes it a valuable archive of environmental information. The elemental composition and concentration of RDS reflect the characteristics of the activities going on in a particular area.

Assessment of RDS characteristics is important for two reasons: (i) the resuspended RDS is a particulate matter (PM) in the air that poses as a serious air pollutant affecting human health and biota; and (ii) rainwater carries it horizontally as well as vertically along with the various chemical constituents like heavy metals in it, thus polluting surface and groundwater.

Heavy metal in the RDS arises from a multitude of sources, viz. water-transported material from surrounding soils and slopes, dry and wet atmospheric deposition, biological inputs, road surface wear, road paint degradation, vehicle wear (tyre, body, brake lining, etc.) and vehicular fluid and particulate emissions[3].

Toxicity of metals has been documentted throughout in history and much more is known about health effects of heavy metals today. Lead is a cumulative poison and it can affect blood, kidney, nervous system and brain. Considering health effects, lead has been phased out as an additive in petrol in India. Nickel can induce cancer of the lung and sinus[4,5]. Nickel in the particulates originates from the combustion of fossil fuels (particularly from oil), smelting, crustal sources and volcanoes[6]. Zinc is considered a nontoxic material; however, the major sources of Zn are reported to be anthropogenic[7], which include fuel combustion, industrial processes and suspended dust[8].

An attempt was made to characterize the RDS in the Middle Brahmaputra Plain, Assam. For this study, RDS samples were collected from: (i) NH-37 at Kaliabor, Nowgong District, on the south bank of River Brahmaputra; (ii) NH-52 at Mission Chariali, Tezpur on the north bank; (iii) the link highway that joins the two highways through a bridge (3008 m long) over the River Brahmaputra and (iv) a market place in Tezpur city, Sonitpur District. All the four sampling locations have varied vehicular density and composition besides other prevalent activities. The vehicular densities during the sampling period for Light Motor Vehicles (LMV) and Heavy Motor Vehicles (HMV) were 80, 60; 90, 50; 70, 20, and 60, 30 numbers/h at NH-37, NH-52, market place and link highway respectively.

Tezpur is one of the most ancient cities in the country and a major city in the north bank of River Brahmaputra, geographically located at 26°37′N and 92°50′E. Human settlement in the region is typically on the side of the highways, which is almost continuous. Also, the highways pass through forests and agricultural fields, and NH-37 runs through the Kaziranga National Park, which is about 30 km east of Kaliabor.

Pre-monsoon samples of the year 2006 were collected on a dry day from both sides of the roads as composite samples on a random basis. An area of about 60 × 60 sq. cm was swept with a brush and dust was collected in a dustpan. It was then transferred to self-sealing polythene bags and taken to the laboratory. Parking places and soiled surfaces were avoided. Care was taken so that the fine particles were not resuspended. All extra materials like metal bits, glass pieces, paper, plastic, etc. were discarded.

For each sampling a new brush and dustpan was used to avoid contamination. For homogeneity in digestion, the samples were ground with mortar and pestle and then sieved (sieve size 500 μm) to exclude materials of extraneous origin. Three locations were chosen randomly to collect samples from all the roads considered for the study and the results are mean values of these triplicate samples. Results that showed an uncertainty of more than 10% were discarded. The samples were analysed for pH[9], electrical conductivity (EC) using conductivity meter taking soil solution (w/v), sulphate by turbidity method (APHA-Method 4500E), nitrate by brucine method (APHA-Method 4500B), percentage organic matter by wet-oxidation by chromic acid[10] and metals (lead, nickel and zinc). Samples were digested in HNO_3 and $HClO_4$ (4 : 1 v/v)[11] and the metals were estimated using Perkin-Elmer Atomic Absorption Spectrophotometer (Model AAS-20) with a detection range of 1.0–60.0, 0.1–60.0 and 0.05–40.0 ppm for Pb, Ni and Zn respectively .

Some important characteristics of the RDS are shown in Table 1. The levels of three important metal concentrations are illustrated in Figure 1.

Lead pollution and its deleterious effects on health have been matters of concern[12,13] for the last few decades. It was claimed[13] as early as in the 1970s that for children in urban surroundings, the dust from the streets and playgrounds is a potentially significant source of lead (over 1000 ppm). In our study lead levels were 241.8 ± 4.0, 177.7 ± 11.9, 495.0 ± 20.9 and 101.6 ± 8.7 μg/g in RDS of NH-37, NH-52, market place and link highway respectively, and the levels are comparable with studies in Delhi (average of 121–200 μg/g)[1] and Bursa City (210 μg/g)[14], Turkey. However, in one

Table 1. Attributes of RDS in the roads of Middle Brahmaputra plain

Parameter	NH-37	NH-52	Market place	Link highway
Pb (μg/g)	214.8 ± 4.0	177.7 ± 11.9	495 ± 20.9	101.6 ± 8.7
Ni (μg/g)	154.9 ± 9.4	98 ± 9.8	94.6 ± 5.9	50.2 ± 7.0
Zn (μg/g)	1.4 ± 0.35	1381 ± 29.3	28.7 ± 3.7	994.1 ± 35.8
pH	7.3	7.8	8	8.4
EC (μS/cm)	103.4	166.4	102.2	247
SO_4^{2-} (μg/g)	14.2	8.4	19	15
NO_3^- (μg/g)	23.2	7.7	54.1	38.6
Organic matter (%)	3	3.1	0.9	1.1

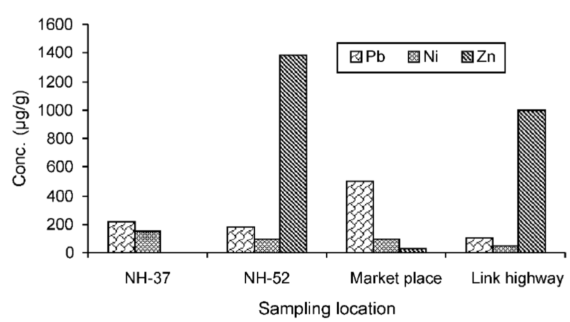

Figure 1. Metal profile of road deposited sediment.

sample at an industrial location in Delhi[1], high lead concentration of 3670 μg/gm was reported. The high prevalence of lead – almost five fold of the link highway – in the market place RDS could be attributed to additional sources of lead other than vehicular contribution.

The levels of Zn at NH-52 (1381 ± 29.3 μg/g) and link highway (994.1 ± 35.8 μg/g) were about 1000 fold higher compared to NH-37 (1.4 ± 0.35 μg/g). An unusually high concentration of Zn at NH-52 and link highway indicates additional sources of Zn besides vehicular contribution. At these two sampling locations motor vehicle and machinery repair work stations are present in close vicinity. The levels of Ni also showed intersite variations, though not as pronounced as in the case of Pb and Zn. An industrial site in Delhi[1] reported a high concentration (1000 μg/g) of Ni. However, our results are comparable with those of a rural traffic location (105 μg/g) and are much on the lower side than the industrial (365 μg/g) and heavy traffic (315 μg/g) location in the same study.

The region is fast moving towards economic development yet a systematic study of environmental status of the region is lacking. Human populations all through the stretch of NH-52, NH-37 and the link highway are at risk of pollution exposure contributed by vehicular traffic. Rich biodiversity adjoining these highways could also be exposed to metal pollution. As RDS is an indicator of the health of an environment, an extensive study on RDS in the region may be carried out to create a large database, which could be of use to understand the possible source of the pollutants and the extent of risk posed. Also, a study on chemical speciation of toxic metals would examine their bio-availability to cause toxic effects.

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Analysis of phytoplankton composition from southern Malabar Coast during the 2005 monsoon as a follow-up of September 2004 stench event

One of the main objectives of this study was to follow-up and deserve whether the holococcolithophore[1] that was predominant in all the samples from the southern Malabar coast during September–October 2004, was prevalent during the monsoon months of 2005. A brief background to this is as follows. During the third week of September 2004, particularly on 16 and 17, an unusual and strong stench was reported from the coast at Kollam and Vizhinjam, Kerala[2,3]. It was reported that the stench could be felt up to 5 km inland from the coast and over 200, mostly children below 15 years complained of nausea, chest pain and short periods of breathlessness[2]. Many were hospitalized, but were discharged within a couple of hours. A press report also stated that the stench was due to dead fish scattered on the beaches and in the water[3]. The report linked the fish death to oxygen depletion and choking of fish gills. Both were reported to be due to proliferation and eventual putrefaction of *Cochlodinium polykrikoides*[2]. Results reported here are from a follow-up study undertaken to decipher whether such organisms are common among the phytoplankton assemblages in the southern Malabar coastal waters. We also recorded their monthly compositional changes in particular, during nutrient enrichment as a consequence of upwelling. Sampling was carried out during the monsoon months of June–September 2005 along the same stretch that was sampled[1] during September–October 2004.

Near-shore water samples were collected once a month mostly during the last week during June–September 2005 from three locations, viz. off Kollam (Sankaccheri), Shankhamughom and off Vizhinjam (Figure 1). They were analysed for various chemical (dissolved oxygen, nitrate-N, nitrite-N, ammonia, phosphate-P and silicate-S) and biological (chlorophyll *a*, cell counts and identification of phytoplankton, total viable counts of bacteria) parameters following standard methods[4].