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Assessment of cadmium (Cd) and chromium (Cr) contamination in vegetables sold in local markets of Bangalore city, Karnataka, India

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Abstract
The study was focused on the concentration of Cadmium (Cd) and Chromium (Cr) contamination in vegetables that sold in local markets of Bangalore city. In this study we used the vegetables and green leafy vegetables such as cabbage, cucumber, cauliflower, green chilli, coriander, spinach. The accumulation of heavy metal was detected by using Atomic Absorption Spectrophotometry (AAS). The obtained results were showed that the concentration of Cadmium and Chromium were slightly exceeding the recommended maximum acceptable limits. The overall study concludes that the atmospheric deposition, untreated sewage water and poor unhygienic marketing systems were plays a main role in elevating the levels of Cadmium (Cd) and Chromium (Cr) in vegetables and green leafy vegetables.

Keywords
bioaccumulation, cadmium, chromium, heavy metals, health hazard

Introduction

Heavy metal contamination in vegetables has been increased in recent years, due to the anthropogenic activies (Tangahu et al., 2011). Unlike in past, nowdays soil pollution is given equal importance as air and water pollution and has become a topic of environmental concern (Divya et al., 2014). Heavy metals contamination is also polluting soil and the vegetables grown in the soil (Nguyen et al., 2010). Sources of heavy metal to the crops are mainly from soil, air and water (Raymond et al., 2011).
Vegetables and green leafy vegetables are considerd as a basic diet among the populations around the world, due to richness in anti-oxidatives effects, fibers, fibers, minerals and vitamins (Theodoros et al., 2016). The vegetabbles and green leafy vegetables are considers as a good absorber of Cadmium (Cd) and Chromium (Cr) from the soil (Mohammed, 2012; Rubaljot et al., 2014). These heavy metals can alter the functional metabolism of some essential trace elements concentrations, by competing for the ligands in biological system (Singh et al., 2011; Jaishankar et al., 2014).
Sewage water is considerd as one of the important source of heavy metal contamination (Oghenerobor et al., 2014). Such untreated sewage water is used for agriculture purposes. Untreated waste water contains more amount of microbial as well as chemical pollutents (Suriyanarayanan et al., 2012; Divya et al., 2015a; Khaled et al., 2016; Jessen et al., 2018). When such moderatly treated wastewater is used for cultivation of crops for a longer period, these heavy metals may

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accumilate in soil (Divya et al., 2015b). The present study was focused on Cadmium (Cd) and Chromium (Cr) contamination in vegetables that sold in local markets of Bangalore city, Karnataka, India.

Figure 1. Geographic location of Bangalore city.

Materials and Methods

Study area

The area chosen for the study is Bangalore city, in Karnataka state which extends 18° 30' North latitude and 74° East longitude. The samples were collected from HAL market, Russel market, Yellahanka market.

Sample collection and analysis

The main sources of the vegetables and green leafy vegetables to the market are from Hoskote, Narsapur, Malur and Anekal. The vegetables and green leafy vegetables such as cabbage, cucumber, cauliflower, green chilli, corriander, spinach were collected. The sampling and analysis process were mentioned in the flowchart 1. A total of 54 plant samples were collected, washed and rinsed with distilled water and then sliced to small pieces. Then the samples were dried at 105˚c for 24 hours. The dried samples were grounded into fine powder and stored in a plastic polythene bags ready for digestion. The samples were digested using a high perfomance microwave assisted digestion. The digested solution was left for automatic ventilation for 10 min. After cooling, the samples was filtered through Whatman filter paper No. 40. The filtered sample was made up to 100 ml with metal free distilled water and stored in a special container ready for analysis. The accumulation of heavy metal was detected by using Shimadzu Atomic Absorption Spectrophotometer (Neelam, 1995; Divya et al., 2015b; Swati et al., 2018).

Flow chart 1. *Sampling process.*

Collection of vegetables samples from different markets

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Oven drying for 80˚c for 5-6 hours

↓

Drying and grinding samples in to fine powder

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Packing the samples in to sample collecting bags and sealed and labelled

↓

Sample subjected for processing in microwave digester and sample were analysed

↓

Using Atomic Spectrophotometer

Results and Discussion

The present study was focused on the status of Chromium (Cr) and Cadmium (Cd) contamination in vegetables which were sold in local markets of Bangalore city (Fig. 3 & 4). The trace metal concentration of Chromium (Cr) was showed higher in cucumber samples (CC1-CC3) when compared to other samples. In case of Cadmium (Cd), the trace metal concentration was showed higher in coriander (CR1-CE3) and spinach (SP1-SP3).

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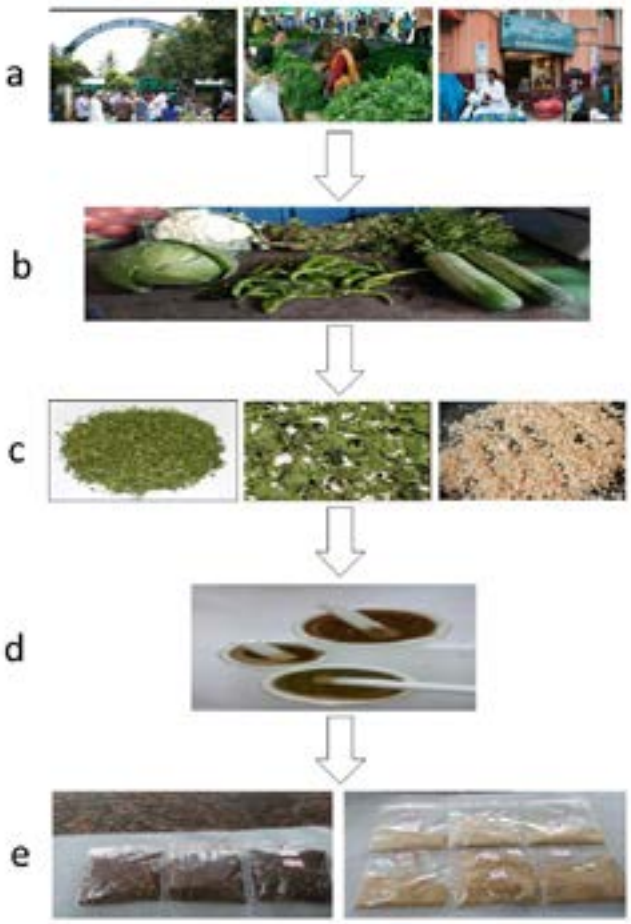

Figure 2. Sampling and analysis:
(a) Market place for samples
(b) Collected vegitables for analysis
(c) Dried samples (d) Grinded samples
(e) Powderd samples.

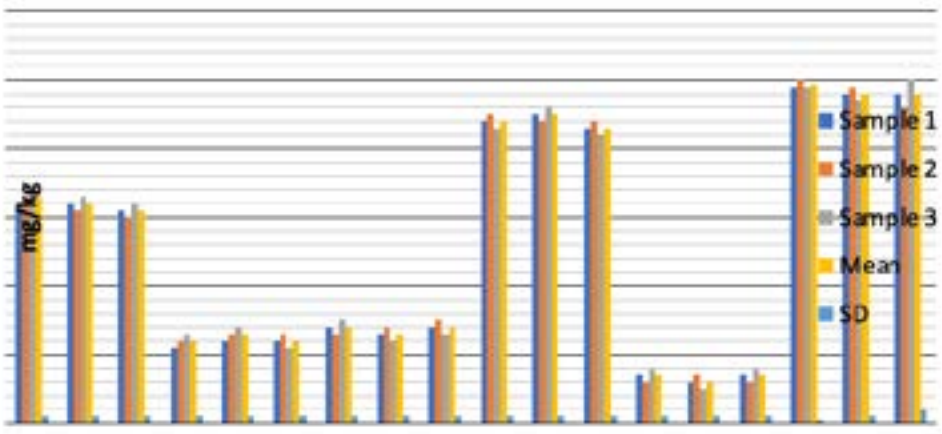

Figure 3. Concentration of Chromium (Cr) in vegetables and green leafy vegetables sold in local markets of Bangalore.

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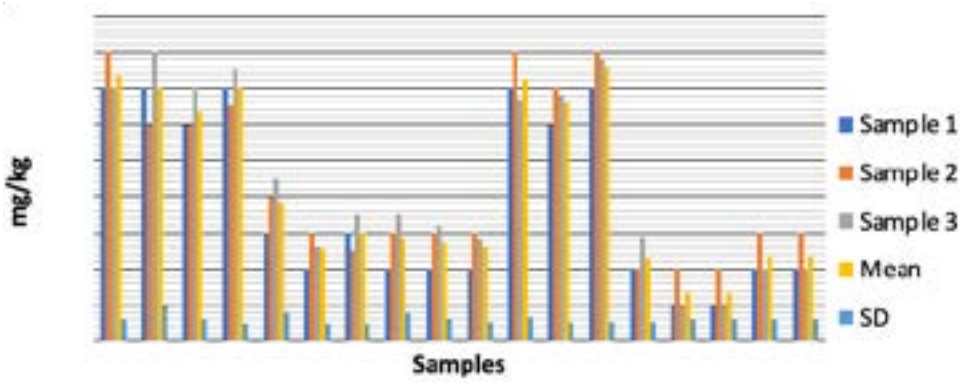

Figure 4. Concentration of Cadmium (Cd) in vegetables and green leafy vegetables sold in local markets of Bangalore.

Conclusions

The present study has generated a preliminary data on trace metal concentration in vegetables and green leafy vegetables sold in local markets of Bangalore city. This study concludes that the concentration of Cadmium and Chromium were slightly exceeded than the recommended maximum permissible levels. The overall study concludes that the atmospheric deposition, untreated sewage water and poor unhygienic marketing systems were plays a main role in elevating the levels of Cadmium (Cd) and Chromium (Cr) in vegetables and green leafy vegetables. The the dietary intake of vegetables with high concentrations of Cd and Cr potentially harmful to humans which cause metabolic disorders.

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Author's contribution:
All author performed equally during the investigation.

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