Keeping in view the objectives of present investigation, the available literature in India and abroad has been reviewed as follow:

Noorjahan et al., (2012) reported that the urbanization and rapid growth of population in India has led to drastic increase in municipal solid waste. Unscientific disposal of municipal solid waste is one of the main reasons attributed for environmental degradation. The present work concentrates on municipal solid waste management in Tiruchirappalli City which comprises of four zones namely Srirangam, Goldenrock, Araiyanangalam and Abishekapuram. This study also attempted to assess the physical composition, characteristics and the heavy metals content in municipal solid waste. It can be observed that the bio-degradable fraction of municipal solid waste is found to be 74 percent of the total solid waste generated from the city. Hence composting could be the best option for the treatment of municipal solid waste.

Bansal (2013) observed in India, that there is a gradual decline in availability of fresh water for irrigation. The sewage and other industrial effluents are being used to irrigate of agricultural fields. This study was undertaken to investigate the effect of continuous application of sewage-effluent irrigation on the DTPA-extractable Cd, Ni, Cr and Pb in soils and crops. For this purpose, peri-urban agricultural lands irrigated by different sewage effluent, from a point of entering the effluents to a distance of nearly 1.5 km and one irrigated by ground water from different parts of Aligarh district were selected where vegetable crops have successfully
been grown. The data indicated that the concentration of these metals in sewage effluent irrigated soils became four to six folds in comparison to ground water irrigated soil. The data also denote that with increasing soil depth and distance from sewage entry point the concentration of these metals decreased indicating a low mobility of these metals in soils. Soil properties viz organic carbon, pH, EC and CEC exhibited positive relationship with DTPA-extractable metal content, while clay content showed a negative relationship. The concentrations of Cd, Ni, Cr and Pb in different vegetable crops grown on sewage effluent irrigated soils were higher (beyond permissible limit) as compared to those grown on ground water irrigated soils. The maximum accumulation of these metals were in potato followed by maize except for Pb. Based on these results, it can be concluded that proper management of water irrigation and periodic monitoring of soil and plant quality parameters are required to ensure successful, safe and long term sewage effluent irrigation.

**Solaiman et al., (2008)** conducted an experiment in the Horticultural Farm of Sher-e Bangla Agricultural University, Dhaka, Bangladesh during the period from November 2006 to January 2007 to study the effect of mulching and different manures and fertilizers on growth and yield of turnip. No mulch (M ) and mulch of water hyacinth (M ) 0 1 were used for mulching treatment and different manures and fertilizer (6 levels) as without manures and fertilizers (F0 ), Cow dung (F1 ), Oil cake (F2 ), Cow dung + Oil cake (F3 ), Urea + Triple Super Phosphate + Muriate of potash (F ) and Cow dung + Urea + Triple Super Phosphate + Muriate of potash (F ) were used. The maximum total 4 5 fresh weight per plant (571.31 g), highest yield per hectare (35.98 t) was recorded from M. The maximum total 1 fresh weight per plant (650.06 g),
highest yield per hectare (40.22 t) was recorded from F. The highest (Tk. 5 322,800) gross return was obtained from M1F5 and the highest (Tk. 174,312) net return was obtained from M1F5. The highest (2.17) benefit cost ratio was attained from M F.

Moustakas et al., (2011) conducted an experiments were conducted on pot marigold (Calendula officinalis L.) plants grown under glasshouse conditions to study interactions between Cd and Zn and the effects of these on the respective concentrations of these metals in plant tissues (leaves and petals). A factorial experiment with two factors (Cd and Zn) at five concentrations (0, 1, 5, 10, 15 mg kg⁻¹) was carried out. Cadmium was applied as CdSO₄·8/3H₂O and Zn as ZnSO₄·7H₂O. Increasing Cd and Zn additions to the soil resulted in an increase in the concentration of Cd and Zn in plant tissues, as well as in the amounts of Cd and Zn extracted by diethylene triamine penta-acetic acid–tri ethanol amine (DTPA–TEA). Significant inhibitory effects of Zn on Cd concentration in the leaves occurred at levels above 5 mg Zn kg⁻¹ soil. Zinc concentrations in the leaves decreased, while those in the petals increased with increasing rates of applied Cd. Cd application increased the Cd/Zn ratio and Zn application reduced the Cd/Zn ratio of plant tissue. DTPA–TEA-extractable Cd and Zn significantly correlated with the Cd and Zn concentrations within the leaves and petals, indicating that such determinations could be used to predict Cd and Zn concentrations in the plant tissues of pot marigold.

Sardar Khan et al., (2013) conducted the to investigate the toxicities of 3 different doses of cadmium (Cd), lead (Pb), and zinc (Zn) in both single and mix forms on the growth parameters (shoot and root fresh and dry weights, root and shoot lengths, shoot diameter, number of
leaves, cell size and mitotic index) of spinach seedlings. Soil from historically uncontaminated site was taken and after air drying and sieving (2 mm mesh sieve) was spiked with selected metals. Plastic pots filled with spiked soil and seedlings of spinach were prepared in greenhouse environment. Growth parameters were calculated according to standards methods and heavy metals were extracted from plant tissues in digestion block with the help of acid mixture (15 ml) of HNO₃, HClO₄, and H₂SO₄ (5:1:1), and concentrations of heavy metals were measured using atomic absorption spectrometer (Analyst 700 of Perk Elmer). Increasing concentrations of Cd, Pb and Zn in both single and mixture forms significantly (p < 0.05) reduced growth parameters of S. oleracea seedlings. The reduction in growth parameters of S. oleracea seedling showed the dose response for Cd, Pb and Zn in both single and mixture forms. The uptake patterns of Cd, Pb and Zn in Cd/Pb, Cd/Zn and Pb/Zn showed antagonistic impacts on each other and uptake pattern was reflected in growth of the seedlings. Toxicities caused by selected heavy metals were highest for Cd followed by Pb and Zn. Highest toxicity was observed in plant seedlings grown on Cd/Pb treated soil

Motesharezadeh, B. and Savaghebi, Gh. R (2012) reported that the pollution of soil by heavy metals is considered to be quite a big problem in many areas of the world. To limit the accumulation of lead and cadmium from soil in the products, a correct understanding of the characteristics and specifications of the translocation of cadmium and lead is necessary. In order to evaluate the effects of cadmium and lead interaction on zinc and manganese concentration, three levels of cadmium (0, 100 and 200 mg/kg), and three levels of lead (0, 200 and 400 mg/kg) were tested on a sunflower cultivar SHF81- 85 in a factorial experimental
design with three replications. The results showed that cadmium has increased the cadmium and lead concentration in the shoot and root, while the effects of lead, were only significant on the concentration of lead in the shoot, and the concentration of both cadmium and lead in the root (p 0.05) the plant. More investigations at field conditions are recommended.

Lakmalie Premarathna et al., (2011) reported that the Intensification of agriculture is likely to result in the accumulation of trace metals due to the excessive use of agrochemicals and amendments. Although agricultural soils can be a long-term sink for trace metals, data on trace metal concentrations are not available for Sri Lankan soils and crops. The objectives of this study were to determine the concentrations of Cd, Cu, Ni, Pb and Zn in soils and vegetable crops in locations where intensive agriculture has been practiced for more than 10 years and to establish relationships between trace metal accumulation and soil properties. Soils were collected at depths of 0–20 cm under vegetable crops from 40 agricultural soils of low country (300 m elevation) wet zones (1700–3300 mm of annual rainfall) of Sri Lanka. Soil pH, CEC, organic matter % and available P and K were determined to establish the relationship between soil trace metal accumulation in soils and soil properties. Crops that were grown in the fields where the soils were collected were analyzed for trace metals. The mean concentrations (mg kg-1) of the trace metals in the soils ascended as follows: Cd (1.18±0.26) < Ni (21±5) < Cu (51±26) < Pb (54±49) < Zn (173±62). Among the tested soil properties, pH, CEC and available P showed significant positive correlations with some trace metals. Mean values (mg kg-1 dry weight) of the trace metals in the plants were 0.59±0.44 for Cd, 11±6 for Cu, 13±9
for Ni, 8±3 for Pb and 40±20 for Zn. Elevated levels of Cd, Cu, Ni, Pb and Zn were observed in both the up country and low country wet zone soils, compared with uncultivated soils. Measured mean values of Cd in a few soils exceeded the maximum allowable limits imposed by the CEC 1986 standard; however, Cd concentrations in the tested vegetable crops were below the maximum permissible levels given by the WHO/FAO in 2009. The Cd to Zn ratio in the studied soils indicated safer limits for Cd in more than 95% of the studied soils. These results provided initial evidence of accumulation of trace metals in Sri Lankan soils and leafy vegetables, emphasizing the importance for further investigations.

**Sekara et al., (2005)** conducted a field experiments from 1999 to 2001 with nine crops (red beet, field pumpkin, chicory, common bean, barley, white cabbage, maize, alfalfa and common parsnip) to determine the cadmium and lead accumulation and distribution in the plants' organs. Based on the obtained results, species suited for phytoremediation were selected. Within the red beet, field pumpkin, chicory, common bean, white cabbage and parsnip the maximum Cd and Pb content was found in leaves. The red beet was characterized by the highest cadmium concentration ratio (shoots/roots). The red beet and common parsnip were characterized by the highest lead concentration ratios (shoots/roots). The phytoremediation efficiency of the investigated crops depended on the biomass production and the possibility of metal accumulation in harvestable organs.

**Amin et al., (2013)** conducted the study to determine the concentrations of toxic heavy metals (lead, cadmium and copper) in some fruits (guava and tomato) and vegetables (onion, okra, sorrel, garden egg, potato, cucumber, carrot and spinach) commonly grown and consumed in
Borno State. The fruits and vegetables were purchased directly from Monday Market Ltd in Maiduguri at their peak seasons. Each sample was subjected to two treatments (washed and unwashed), dry-ashed at 500 - 550°C for 12 – 18 hours to extract the heavy metals (analyze) and each analyses was subsequently quantified using Atomic Absorption Spectrophotometer (AAS). The results indicate that the concentration of copper was negligible in all the crops; the highest concentrations of the metals were observed in spinach, these were 0.2250 ppm and 0.0325 ppm of lead and cadmium, respectively. The concentration of lead was higher (P 0.05) in the unwashed sample (0.1121 – 0.5010ppm) compared with 0.0132 – 0.2250ppm for the washed samples; that of cadmium were 0.0023 – 0.721ppm and 0.0010 – 0.0325 ppm in the unwashed and washed samples, respectively. Significant difference (P 0.05) was observed in the concentration of the metals between and within crop samples indicating the effects of crop types on metal concentration. The leafy vegetables had higher (P 0.05) concentrations of the metals than the fruits. The fact that considerable amounts of the metals were removed by washing suggests that the contamination was a surface type.

Shaha et al., (2012) conducted an experiment to investigate the effect of lime and farmyard manure on the concentration of cadmium in water spinach. Water spinach (Ipomoea aquatica cv. Kankon) was grown in sandy loam soil spiked with 5 mg Cd Kg⁻¹ with lime (L) and farm yard manure (M) amendments. The treatments consisted of control, four levels of L (5, 10, 15, and 20 t ha⁻¹), M (5, 10, 15, and 20 t ha⁻¹), and their combinations (5 + 5, 10 + 10, 15 + 15, and 20 + 20 t ha⁻¹). Growth parameters of water spinach increased significantly with the addition of lime and farm yard manure in the soil. Lime addition to soil decreased Cd
concentration in both shoot and root of water spinach. In control (0 + 0), Cd concentration was 62.67 mg kg\(^{-1}\) in shoot, and 135.5 mg kg\(^{-1}\) in root. Cadmium concentration decreased by 72, 15, and 66% over the control in shoot and 82, 28, and 76% in the roots correspondingly with the highest rate of lime (20 t ha\(^{-1}\)), manure (20 t ha\(^{-1}\)), and lime plus manure combinations (20 t ha\(^{-1}\) + 20 t ha\(^{-1}\)). The results imply that 5 to 10 t ha\(^{-1}\) lime could be used in Cd-contaminated soils to reduce Cd uptake by agricultural crops.

Auda et al.,(2011) reported the measurements of Pb, Zn, Cd and Fe concentrations in the soils and accumulation in edible parts of several crop plants (spinach, wheat, strawberry, carrot, onion, squash, cabbage, potato, faba bean and cucumber) grown in three sites of the northern area of Gaza Strip, Palestine, revealed: (1) Concentrations of metals were in normal range in soil, except for lead concentrations which in some samples were higher, especially in the sites of Al-Monttar and Gaza city center. (2) Accumulation of heavy metals by the crop plants was within normal ranges, except for lead concentration which exceeded normal ranges, yet not reaching toxic levels in all plants but the onion bulb which reached toxic level. (3) Cadmium was concentrated at equal levels in different soil samples, while its accumulation in plant samples was very low and sometimes was not detectable. Measurements of physiological attributes of spinach plants revealed: (1) Growth characters such as root length, shoot height, fresh and dry weights of shoot and root were decreased with increasing Cd soil addition either alone or combined with Zn soil addition at all levels. (2) Plant pigments such as chlorophyll a, chlorophyll b and total carotenoids significantly decreased, with increasing Cd soil addition either alone or combined with Zn at all levels,
except for chlorophyll a which increased with increasing Zn soil addition, with some exceptions. (3) Zn addition was highly correlated to growth characters, as well as when combined with Cd at different levels may be overcome the toxicity of Cd on growth characters, mineral concentrations and chlorophyll a content.

Mani et al., (2013) conducted a pot experiment in order to find out the natural potential of Indian mustard (Brassica juncea L.) for cleanup of lead (Pb) contaminated soil. At the rate of 50 mg/kg of applied Pb, there was maximum reduction in the root dry biomass (46.94%) and shoot dry biomass (46.25%) of Brassica juncea L., but 10 mg/kg applied Pb promoted the dry biomass root and shoot to some extent. The concentration of Pb in tissues followed the order: root>shoot. Indian mustard recorded the maximum concentration of Pb in root and shoot (75.58mg/kg and 36.25 mg/kg, respectively) in the combinatorial treatment (T16) comprising of 50 mg/kg of applied Pb along with 1g/kg elemental sulphur (S) and 8g/kg vermicompost (VC). Therefore, it is suggested to apply recommended doses of elemental S(30 kg/ha) and vermicompost (20 t/ha) in Pb-contaminated soils. It was concluded that Indian mustard could be safely grown in the low level of Pb-contaminated soils and it is useful for lead phytoremediation.

Joshi et al., (2011) conducted a greenhouse experiments and the toxicity threshold limits of cadmium (Cd) were evaluated for amaranthus, fenugreek and buckwheat grown in a mollisol fertilized with varying levels of farm yard manure (FYM). The soil treatments involved factorial combinations of three levels of FYM (0, 2.23 and 4.46 g kg$^{-1}$ soil) and seven levels of Cd (0, 5, 10, 25, 50, 100 and 150 mg Cd kg$^{-1}$ soil). Increasing levels of Cd in the mollisol decreased the dry matter yields.
The toxicity threshold limits of Cd for 10% reduction in the relative yields in 0, 2.23 and 4.46 g FYM kg\(^{-1}\) soil were 7.3, 30.5 and 11.0 mg Cd kg\(^{-1}\) dry matter in amaranthus, 2.5, 3.6 and 4.9 mg Cd kg\(^{-1}\) dry matter in fenugreek and 6.4, 21.0, 16.0 mg Cd kg\(^{-1}\) dry matter in buckwheat, respectively. The toxicity threshold limits of 0.1 MHCl-extractable Cd in soil amended with 0, 2.23 and 4.46 g FYM kg\(^{-1}\) soil were 2.0, 4.5 and 2.2 mg Cd kg\(^{-1}\) soil for amaranthus, 2.5, 5.0 and 22.2 mg Cd kg\(^{-1}\) soil for fenugreek and 2.8, 12.5 and 19.0 mg Cd kg\(^{-1}\) soil for buckwheat, respectively. The toxicity threshold limits of 0.005 \(M\) DTPA (pH 7.3)-extractable Cd in soil amended with 0, 2.23 and 4.46 g FYM kg\(^{-1}\) soil were 1.3, 2.6 and 2.1 mg Cd kg\(^{-1}\) soil for amaranthus, 1.6, 2.9 and 9.6 mg Cd kg\(^{-1}\) soil for fenugreek and 1.6, 11.5 and 6.9 mg Cd kg\(^{-1}\) soil for buckwheat, respectively. Based on plant tissue concentrations of Cd, amaranthus was less susceptible to Cd toxicity than fenugreek and buckwheat. Application of FYM to soil helped to reduce uptake and mitigate toxicity of Cd in leafy vegetables.

**Mani et al., (2014a)** observed a field experiment to find out the effect of organic matter and single superphosphate on the uptake of cadmium by Radish \((Raphanus sativus\) L.) on the alluvial soil of Sheila Dhar Institute experimental farm, Allahabad. Three levels of organic matter (0, 10 and 20 t ha\(^{-1}\)), single super phosphate (0, 100 and 200 kg ha\(^{-1}\)), Cd (0, 5 and 10 mg kg\(^{-1}\)) were applied as compost, SSP and CdCl\(_2\), respectively. Addition of 200 kg ha\(^{-1}\) SSP increased the maximum dry biomass yield of Radish by 31.7% over the control. The application of 10 mg kg\(^{-1}\) Cd maximum reduce dry biomass yield of Radish by 17.5% over the control and registered the highest accumulation of Cd in shoot and root of Radish by 2.0, 2.4 fold over the control, respectively. Therefore,
200 kg ha\(^{-1}\) SSP applications may be recommended to enhance biomass yield of *Raphanus sativus* L. and phytoremediation of cadmium-contaminated soil through soil-plant rhizospheric processes.

**Mani et al., (2014b)** observed that the ability of hyper-accumulator oilcake manure as compared to chelates was investigated by growing *Calendula officinalis* L. for phytoremediation of cadmium and lead contaminated alluvial soil. The combinatorial treatment T6 [2.5 g kg\(^{-1}\) oilcake manure + 5 m mol kg\(^{-1}\) EDDS] caused maximum cadmium accumulation in root, shoot and flower up to 5.46, 4.74 and 1.37 mg kg\(^{-1}\) and lead accumulation up to 16.11, 13.44 and 3.17 mg kg\(^{-1}\), respectively at Naini dump site, Allahabad (S\(3\)). The treatment showed maximum remediation efficiency for Cd (RR=0.676\%) and Pb (RR=0.202\%) at Mumford ganj contaminated site (S2). However, the aforesaid parameters were also observed at par with the treatment T5 [2.5 g kg\(^{-1}\) oilcake manure + 2 g kg\(^{-1}\) humic acid]. Applied EDDS altered -a, chlorophyll–b, and carotene contents of plants while application of oilcake manure enhanced their contents in plant by 3.73-8.65\%, 5.81-17.65\% and 7.04-17.19\%, respectively. The authors conclude that *Calendula officinalis* L. has potential to be safely grown in moderately Cd and Pb-contaminated soils and application of hyper accumulator oilcake manure boosts the pigments of the plant, leading to enhanced clean-up of the cadmium and lead-contaminated soils. Hence, the hyper accumulator oilcake manure should be preferred over chelates for sustainable phytoremediation through soil-plant rhizospheric process.