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# Jacaranda Mimosifolia. D.Don.; – a powerful solution for environmental degradation caused by urbanization in urban greening

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**Abstract:** *Urbanization is a process that leads to the growth of cities due to industrialization and economic development, and that leads to urban- specific changes in specialization, labor division and human behaviors. Most part of the environment destroyed by the urbanization. It leads to environment become changed their properties. Changes in Air Quality: Human activities release a wide range of emissions into the environment including carbon dioxide, carbon monoxide, ozone, sulfur oxides, nitrogen oxides, lead, and many other pollutants. Changes in Patterns of Precipitation Cities often receive more rain than the surrounding countryside since dust can provoke the condensation of water vapor into rain droplets. Erosion and other changes in land quality: Rapid development can result in very high levels of erosion and sedimentation in river channels. The blue jacaranda has been cultivated in almost every part of the world where there is no risk of frost; established trees can however tolerate brief spells of temperatures. Urban greening controls the environmental changes due to the urbanization.*

*This paper focuses mainly on the role of Jacaranda mimosifolia one of the main urban forestry crop, in urban greening and its impact on the mineralization of urban soil.*

## I. INTRODUCTION

The population of India is growing at the rate of about 17 million annually which means a staggering 45,000 births per day and 31 births per minutes. If the current trend continues, by the year 2050, India would have 1620 million populations. Due to uncontrolled urbanization in India, environmental degradation has been occurring very rapidly and causing many problems like shortages of housing, worsening water quality, excessive air pollution, noise, dust and heat, and the problems of disposal of solid wastes and hazardous wastes (Uthara *et al.*, 2012).

- 1) *Pollution:* Pollutants are often dispersed across cities or concentrated in industrial areas or waste sites. Lead- based paint used on roads and highways and on buildings is one such example of a widely dispersed pollutant that found its way into soil. Burying tremendous amounts of waste in the ground at municipal and industrial dumps.
- 2) *Degraded Water Quality:* The water quality has degraded with time due to urbanization that ultimately leads to increased sedimentation there by also increasing the pollutant in run-off. Modification of Habitats: The fertilizers that spread across lawns find its way into water channels where it promotes the growth of plants at the expense of fish. The waste dumped into streams lowers oxygen levels during its decay and cause the die-off of plants and animals.
- 3) *Pollution Control:* Pollution in cities as a form of pollutants includes chemicals, particulate matter and biological materials, which occur in the form of solid particles, liquid droplets or gases. Air and noise pollution is common phenomenon in urban areas. The presence of many motor vehicles in urban areas produces noise and air pollutants such as carbon dioxide and carbon monoxide. Emissions from factories such as Sulphur dioxide and nitrogen oxides are very toxic to both human beings and environment. The most affected by such detrimental contaminants are children, the elderly and people with respiratory problems. Urban greening can reduce air pollutants directly when dust and smoke particles are trapped by vegetation. Re-search has shown that in average, 85% of air pollution in a park can be filtered (Sorensen, 1997).

## II. MATERIALS AND METHODS

Using standard methods dried powders of both the fresh leaf sample and leaf litter sample are tested for their mineral content. 100 grams of each sample were tested and monitored. Then the estimated values are compared to find weather the fresh leaf or leaf litter contain more minerals.

**A. Collection of Materials**

For the current study both the fresh leaves and the leaf litter of *J.mimosifolia* are collected separately and dried to the minimum moisture content under shade. The dried materials were then finely powdered with a blender. The extracts are then kept in separate air tight plastic bags in room temperature for further research analysis.

Plate - 1: Location Map

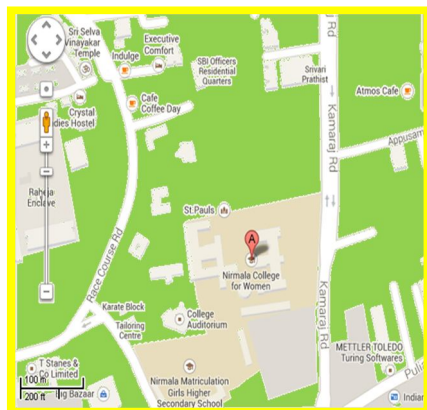
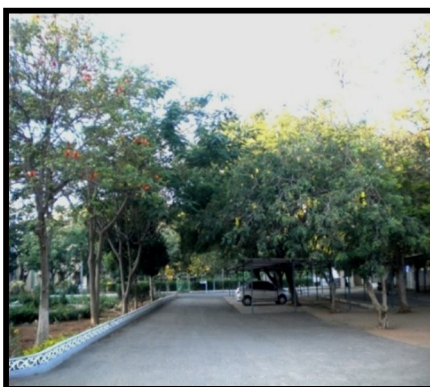


Plate -2: Study Area



Jacaranda Mimosifolia, D.DON.;

Systematic Classification

Kingdom : Plantae

Order : Lamiales

Family : Bignoniaceae

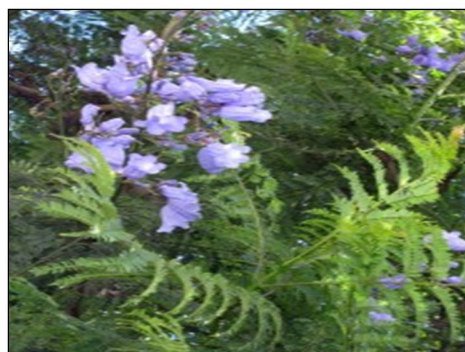
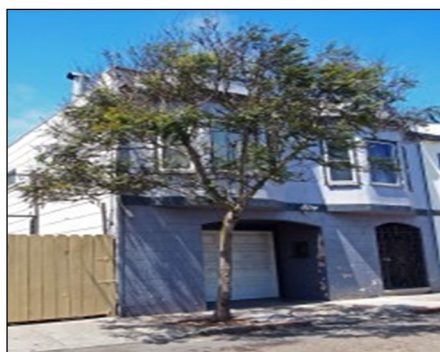
Genus :Jacaranda

Species : J. mimosifolia, D.Don.;

**B. Plant Description**

*Jacaranda mimosifolia* is a sub-tropical tree native to south-central [South America](#) that has been widely planted elsewhere because of its beautiful and long-lasting blue flowers. It is also known as jacaranda, blue jacaranda, black poui, or as the fern tree down to around  $-7^{\circ}\text{C}$ . The tree grows to a height of up to 20 m. Its bark is thin and grey-brown in color, smooth when the tree is young though it eventually becomes finely scaly. The twigs are slender and slightly zigzag; they are a light reddish-brown in color. The flowers are up to 5 cm long, and are grouped in 30 cm [panicles](#). They appear in spring and early summer, and last for up to two months. They are followed by woody seed pods, about 5 cm in diameter, which contain numerous flat, winged seeds. The leaves (Plate 2) are light green, fernlike, 45 cm long bi-pinnately compound leaves with small oval leaflets little more than 1 cm long. In fall, some foliage yellows and drops; new foliage may appear quickly or branches may remain bare until bloom. The Blue Jacaranda belongs to the section *Monolobos* of the genus *Jacaranda*. According to IUCN (2.3) report, *Jacaranda mimosifolia* is included in the threatened category with a conservation status of vulnerable.

Plate 3: Entire view of *J.mimosifolia*      Plate 4: Leaves of *J.mimosifolia*





### C. *Jacaranda Mimosifolia*- In Urban Greening

The selection of suitable plants for the urban forestry follows certain selection criteria. Selecting high quality nursery trees is the most important aspect of these criteria. To do that, choose plants with good root systems and healthy, well-formed and undamaged crowns and trunks. In addition, any plant that you purchase should have a professional pedigree: grown in a nursery, dug and prepared for shipping by trained workers, and maintained properly while awaiting purchase. These plants from nurseries with good reputations and whose people you trust. Chances are that plants from reputable nurseries will have been treated properly and will establish reliably.

### D. *Mineral Profiling of Samples*

The goal in selecting nursery plants is to purchase those plants most likely to become successfully established and to mature in the landscape in order to meet design expectations with a minimum of maintenance. The following are the special adaptive features of *Jacaranda mimosifolia*. D. Don to be treated as a suitable urban plantation crop in India.

### E. *Trunk and Branch Characteristics*

The shoots should show good vigor and growth. Branches should be well-spaced and have good branch attachment. The tree is slightly canopy like and Crowns are reasonably free of wounds and/or evidence of insect damage and/or disease. Trunks are straight, free from wounds or diseases and show trunk flare and proper trunk taper.

### F. *Foliage Characteristics*

Leaves have good color, with no sign of insect pests and/or diseases. There is an adequate number and size of leaves. Leaf margins are not scorched. Scorched leaves are a sign of water stress.

### G. *Root Characteristics*

Roots have a good connection with the shoot- a gentle rock can move the entire root ball. Roots are not pot-bound and, if the plant is gently removed from its spot, healthy whitish root tips can be seen.

### H. *Post Planting Maintenance*

*J. mimosifolia* D. Don is most suitable in soil which can be easily drained- like sandy soil. It implies that there is no need of frequent irrigation of the plant. A little irrigation is necessary to keep rootball moist, but not too wet. As the plant grows fast up to a moderate height of 20-35 inches and spread up to 15-25 inches fertilization is not a necessity.

### I. *Soil Fertilization*

The presence of any plants or trees can prevent the soil erosion and soil pollution. Fallen leaves and other tree components provide a vital service to the soil below by acting as a mulch and fertilizer. Leaf litter also serves as home to numerous insects and helpful bacteria. *J. mimosifolia* as a semi-deciduous tree sheds its leaves off largely and the fallen leaves, ie. "leaf litter" then decayed and form humus- the fully degraded organic manure- in which the minerals occur separately, providing a complete fertilization for the underlying soil.

The current paper focuses mainly on the mineral analysis of *J. mimosifolia* leaves were to compare the mineral contents in the fresh leaves to the mineral content in the leaf litter.

## III. RESULTS AND DISCUSSION

The mineral assay shows that both fresh leaf sample and leaf litter of *J. mimosifolia*. Contains various essential micronutrients such as potassium, phosphorus, calcium, magnesium, iron and sodium in an appreciable amount (Table- 1). The concentration of each mineral are calculated and monitored in mg/100 gm of sample.

In fresh leaf sample the concentration of potassium was estimated as 1560 mg/100gm and that of leaf litter was 974 mg/100gm. Phosphorus content was 450 mg/100gm in leaf sample and 280 mg/100gm in leaf litter. Fresh leaf sample contains 1898 mg/100gm of calcium and that of leaf litter was 1090 mg/100gm. 440 mg/100gm of magnesium was estimated in fresh leaf sample while 298 mg/100gm was present in leaf litter. In a trace amount, iron and sodium was also present in both sample such as 40 mg/100gm and 28 mg/100gm respectively in fresh leaf sample and 38 mg/100gm and 10 mg/100gm in leaf litter of *J. mimosifolia*. D. Don.

Potassium and phosphorus are the primary micronutrients required essentially by plants. Potassium plays a vital role in photosynthesis. It regulate the opening and closing of stomata, and therefor regulates CO<sub>2</sub> uptake. Phosphorus is essential for all

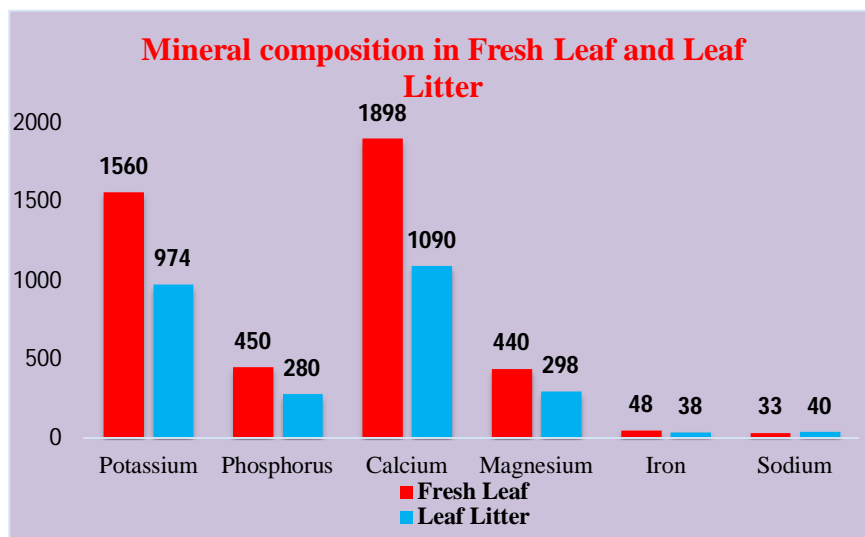
living organism. Plants must have phosphorus for normal growth and maturity. Calcium in the form of calcium pectate, is responsible for the holding together of cell walls of plants. Magnesium is another essential plant nutrient. It has a wide range of key role in photosynthesis as a building block of chlorophyll. Iron is also involved when a plant produces chlorophyll, which gives the plants oxygen as well as its healthy green color. Sodium, although being not much essential for plants, it can be used in small quantities similar to micronutrients, to aid in metabolism and synthesis of chlorophyll.

Although the similar distribution of minerals can be seen in both fresh leaf and leaf litter of *J.mimosifolia* the quantitative estimation shows that the amount of each minerals show a considerable difference. More precisely, the leaf litter contains lesser amount of minerals than in fresh leaf sample (Figure 1). But when comparing the results with the mineral content of other plants, *J.mimosifolia* provides higher supplement of micronutrients to the soil.

Table 1: Mineral content of fresh leaf and leaf litter of *J.mimosifolia*

| S. No | Parameters | Concentration (mg/100 gm) |               |
|-------|------------|---------------------------|---------------|
|       |            | Fresh Leaf                | Leaf Litter   |
| 1     | Potassium  | 1560 mg/100gm             | 974 mg/100gm  |
| 2     | Phosphorus | 450 mg/100gm              | 280 mg/100gm  |
| 3     | Calcium    | 1898 mg/100gm             | 1090 mg/100gm |
| 4     | Magnesium  | 440 mg/100gm              | 298 mg/100gm  |
| 5     | Iron       | 48 mg/100gm               | 38 mg/100gm   |
| 6     | Sodium     | 33 mg/100gm               | 40 mg/100gm   |

Figure -1: A comparison of mineral composition in fresh leaf and leaf liter of *J.mimosifolia*



A. Summary

Urbanization and migration of people to cities results in the degradation of natural resources as the soil, air and water in urban areas got polluted due to the increased human interference and industrialization. The current work on role of *J.mimosifolia* in urban greening and in counteracting the harmful environmental effects of urbanization reveals that, urban greening can be the best weapon to protest these issues. The urban greening requires the selection of specific plants that tolerate the environmental stress condition in cities. *J.mimosifolia* being a most suitable urban crop that can tolerate all the harmful urban condition such as; lack of adequate irrigation, less fertile soil, contaminated air etc. As it is an ornamental plant, the attractive canopy like appearance of the tree, well arranged compound leaves and the panicles of showy and colorful flowers of *J.mimosifolia* makes the cities to look more attractive and tidy. Apart from all, the semi deciduous leaves and leaf litter formed in soil can make the soil more fertile and unpolluted, where the current work meets its success.



#### IV. ACKNOWLEDGEMENT

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