K.V.R. GOVERNMENT COLLEGE (W), (A)
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KURNOOL – 518004

A REPORT ON WASTE MANAGEMENT

2021 - 2022

WASTE MANAGEMENT COMMITTEE

S.No	Name	Designation
1	Dr. M. Indira Shanti	Vice Principal
2	Dr.M.Farida Begum	IQAC Coordinator
3	Sri.Ranga Reddy	HOD Department of Botany & Co-ordinator
4	Dr.S.Sunitha	PG Co-ordinator Department of Botany, Member
5	Smt.Kalpana	HOD Department of Chemistry, Member
6	Dr.. G. Indravathi	HOD Department of Biotechnology, Member
7	Dr.B. Dhana Sree	HOD Department of Biochemistry, Member
8	Ms.Lavanya	Student Representative
9	Ms.Neeraja	Student Representative

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INTRODUCTION

The Vedas declare that the whole of the world is ***'Panchamahabhootaatmakam'***. That means, the world is made up of five prototype elements, namely, Earth (Prithvi), Water (Apor), Fire (Agnior), Air (Vayu) and the Ether (Akash,Space).

The '***Taittiriya Upanishad'*** in the following verse expresses salutations to the elements of nature.

Harih aum, s'am no mitras, s'amvarunah, s'am no bhavatyaryama

s'am no indrobrihaspatih, s'am no vayururukramah, namobrahmane,

amastevaayo, tvaamevapratyakshambrahmaasi, tvaamevapratyaksham

brahma vadisyaami, ritamvadisyaami, satyamvadisyaami, tan maamavatu,

tadvaktaaramavatu, avatumaam, avatuvaktaaram, aum santih, santih, santih!

Aum! May Mitra (Sun), be propitious to us, may Varuna be propitious to us, May the Aryaman (a form of Sun) be propitious to us, may Indra and Brihaspati be propitious to us. May the Vishnu of far strides be propitious to us. Salutation to Brahma, salutation to you O! Vayu! Indeed you are the visible Brahman and I declare you as the only perceptible Brahman. I will speak of the right. I will speak of the truth. May that protect the speaker. May that protect me. Let that protect the speaker. Aum! Peace!, peace!, peace!

The initiatives which contribute to the quality enrichment of the environment are termed as 'Green. The systematic study that includes plant statistics, quality testing of soil, air, ground water, drinking water, electricity consumption, means of management of solid wastes and e – wastes is known as the 'Green or Environmental audit'. This college was established in the year 1958 and its campus is spread across 14 acres. The campus is endowed with many big trees and a lot of greenery. A 'Green Audit' committee comprising of Principal, IQAC Coordinator, the Lecturer in-charge of Department of Botany as Coordinator, lecturer in-charges of Zoology, Chemistry, Biotechnology, Biochemistry departments as members and two student representatives. The prime objectives of this committee are as follows.

- Qualitative and quantitative enrichment of greenery in the college campus
- Sustenance of soil quality.
- Maintaining air quality in the college campus
- Maintaining ground water quality in the college campus.
- Maintainance of waste Chemicals from laboratories
- Solid waste and e – waste management in the college campus.

Chapter I: The Kaleidoscope of KVR Campus Flora

"A Flora is a book in which species are described, while the word flora *refers to the totality of plant species in an area; in other words, a flora is described in a Flora".*

The term 'flora' refers to the plant life that exists in a particular place at a particular time. This typically includes all indigenous plant life, and the use of flora in this fashion was coined by the French-Swiss botanist and geologist Jules Thurmann. Flora and fauna are umbrella terms that refer to many different types of life. What is counted as flora and fauna is dependant upon the specific region, climate, or time period.Flora can be subdivided into special classifications: native flora, weed flora, and horticultural flora. Native flora obviously refers to the indigenous or native flora in a specific area. Horticultural flora refers to the flora that is cultivated by humans for use, so it refers to agricultural plants. Weed flora is usually used in reference to undesirable plants, those which humans wish to remove from a particular region. This term has somewhat fallen out of favor, as it actually refers to different kinds of plants including invasive species, native species that interfere with agriculture, and weedy species. The term flora can also be used to refer to a publication containing documentation on the plants within a region.

Floristic publications document and describe the diversity of a given group of plants growing in specific geographic areas. They may be floras of algae, mosses, ferns, gymnosperms, and angiosperms or combinations of these groups. Floras are important because they allow both amateur and professional botanists to identify plants—the first step in developing a deeper appreciation of plants and for carrying out research on them.It is difficult to determine when the botanical exploration necessary for writing a Flora or a Mycota has gathered enough collections to make the inventory as complete as possible.Publishing too early makes the Flora so incomplete that it becomes difficult for users to identify the plants they find.To determine the time to publish the KVR campus Flora, we f made a graph to demonstrate how many new species for the Flora were gathered on each new expedition.We had collected most of the common species and, thus, had to work harder to find species we had not yet inventoried. If a species could possibly be new to the Flora, we were willing to spend hours collecting the specimens needed to add that species to our Flora

Geographical Description of the College:

Latitude:15.83

Longitude:78.03

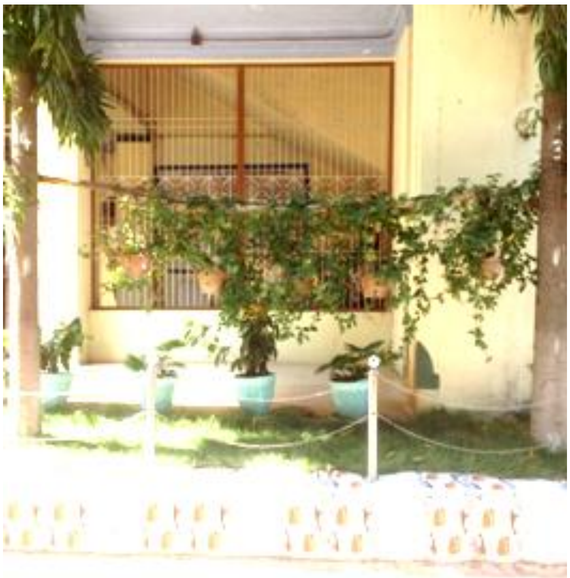
MAP of KVR college:

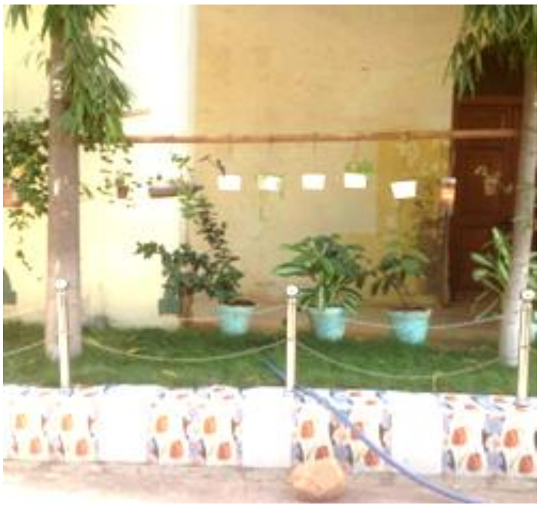
Need of the study:

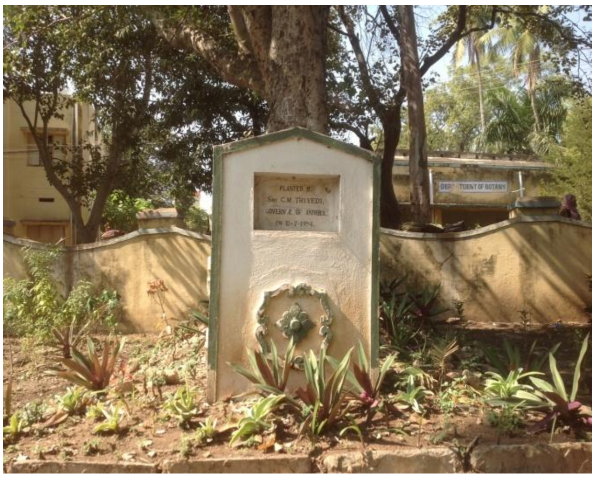
Floristic studies are taxonomic studies of a flora of a major segment of any given area.These studies help us to assess the plant wealth and potentiality of any given area. They also help us to understand the basic aspects of biology such as speciation, isolation endemism and evolution.

Various ecological factors mainly biotic changes result in change in the floristic components. The total number of species may be changed, dominant species may be replaced with other species which may result in the floristic composition of family:genus:species ratio. This resulted in enumerating the local floristic diversity of the campus to aim at an inventory of the angiospermic species of KVR College by the students and staff of Department of Botany.

PHOTO GALLERY







Chapter – II: A Report on Aqua & Soil Quality in KVR College Campus

The Water is one of the prime necessities of life. We can hardly live for a few days without water. In a man's body, 70-80% is water. Cell, blood, and bones contain 90%, 75%, and 22% water, respectively. Physico-chemical parameter of any water body plays a very important role in maintaining the fragile ecosystem that maintains various life forms. Drinking water is one of the basic needs of life and essential for survival. A few properties of water samples were determined by using standard analytical methods. Permissible limits for drinking water quality according to Central Pollution Control Board (CPCB) .The following methods are used for test water quality.

This study consisted of estimation of some physiochemical properties in water samples of our college campus to ascertain the quality of water. Samples were taken from two sampling points and analyzed for the following parameters like pH, EC, turbidity, alkalinity,total hardness, BOD and COD.

2.1 Sample collection:

1. The drinking water samples were collected in prewashed (with detergent, diluted HNO_3 and doubly de- ionized distilled water, respectively) polyethylene bottles. pH and conductivity of the samples were measured while collecting the samples.

2. Each water sample was taken tfour times at four different sampling periods approximately three month apart. Samples were collected in the month of October 2018.The determination of the properties of the water samples were performed on the same day of sampling.

2.2. Methodology: Almost all water treatment plants are required to measure BOD and COD as a measure of the pollution value in the water.

Turbidity is a measure of the cloudiness of water. It has no health effects. Howeverturbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease causing organisms. These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.

Biological Oxygen Demand: Biological Oxygen Demand is defined as the amount of oxygen required by bacteria and other microorganisms in stabilizing decomposable organic matter. It is supposed to estimated by 5-Day BOD Test method . One sample is analysed immediately to measure the initial dissolved oxygen concentration in the effluent, often using a Winkler titration methods. The second BOD bottle is sealed and stored at 20 ^{0} C (the samples are stored in the dark to avoid photosynthetic oxygen generation. After 5 days the amount of dissolved oxygen remained in the sample is measured. The difference between the initial and ending oxygen concentrations is the BOD_5.

$$[BOD] = [DO]_{Final} - [DO]_{Initial}$$

Chemical Oxygen Demand: COD is used as a general indicator of water quality and is an integral part of all water quality management programmes. Additionally, COD is often used to estimate BOD as strong correlation exists between COD and BOD. However COD is a much faster and more accurate test.

Relation between BOD and COD: As BOD is a measure of the amount of oxygen requiredfotr the bacteria to degrade the organic components present in the water or waste water, COD is the total measurement of all chemicals in the water/waste water. The ratio of BOD/COD : COD is higher than BOD a maximum of upto 4 times in medium scale industries.

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3. Results : The average physical and chemical properties of the drinking water samples including pH, electrical conductivity, turbidity, BOD and COD were listed in the following table

SL. No	Type of Water sample	pH		EC mg/l		Turbidity NTU		BOD mg/l		COD mg/l	
		Sample	CPCB Permissible limits value	Sample	CPCB Permissible limits value	Sample	CPCB Permissible limits value	Sample	CPCB Permissible limits value	Sample	CPCB Permissible limits value
1	Tap water	7.42	6.5-8.5	1200	2000	7	10	0.05	3	8.65	255
2	Mineral water	7.09	6.5-8.5	800	2000	6	10	0.02	3	5.69	255
3	Waste water effluents	8.0	6.5-9.0	1900	2000	9	10	2.6	3	17.88	255

4. Discussion and Conclusion: In conclusion, the concentrations of the investigated major phsicochemoca; properties in the drinking water samples of KVR College, Kurnool were found below the guidelines for drinking waters given by the Central Pollution Control Board(CPCB),

Further research on water analyses is required as levels of contaminants may vary due to different soil types, water chemistry and different human activities.

Soil: Soil is one of the most precious resources of the earth and is a dynamic living layer forming the foundation of all eco-systems. Physiographically KVR College lies at an altitude of 299.26 m.

Objectives: 1. To study the physical, physico-chemical and chemical characteristics of soil of College campus.

Methodology:

1. Survey:Soil samples were collected at two different depthsie 0-15 cms and 15-30 cm by covering three different locations in the college and mixed thoroughly, pooled as one sample(0-30 cm). The samples were air dried and passed through 2 mm sieve and used for partical size distributio

Physical characteristics like soil texture, bulk density and physicochemical characteristics like soil reaction and electrical conductivity and chemical characteristics like available nitrogen, available phosphsrous and available potassium word determined.

2.Soil analysis : the analytical methods employed for the determination of physical, Physico-chemical and chemical characteristics of soil are as follows.

A. Particle size analysis: different textural fractions were estimated and expressed as coarse sand, fine sand, silt and clay by Piper method.

S.No	SOIL PARAMETER	METHOD
1	Practical size analysis(texture)	Bouyoucos hydrometer method(Piper ,1966)
2	Bulk density	Clod method(sing ,1980)
3	Soil reaction(pH)	ElicoDigisum digital pH meter(jackson ,1973)
4	Electrical Conductivity(EC)	Systronics conductivity bridge(jackson,1973)
5	Available Nitrogen	Alkaline Potassium Permanganate method(Subbaiah and Asija 1956)
6	Available phosphorus	Olsens extractant (1954)
7	Available potassium	Systronic flame photometer128(Jackson1973)

RESULTS: The soil analysis was done for important physical, physico chemical and chemical parameters. The data obtained is presented in the table given below.

Sl. No	Location	Particle size distribution(%)	Bulk Density(Mg m-3		
			sand	silt	clay
1.	College hostel	69.24	6.80	23.96	1.11

2.	College campus	70.24	4.80	24.16	1.16

Sl. No	Location	pH	E.C(dSm-1)
1.	College hostel	7.56	0.24
2.	College campus	7.06	0.29

Sl. No	Location	Major nutrients(kg ha-1)		
		N	P	K
1.	College hostel	407	39.55	4
2.	College campus	410	37.54	421

The medium to high available nitrogen status in the soil samples might be due to continuous application of higher doses of organic manures and inorganic fertilizers.The high availability of phosphorus may be due to presence of high organic matter which favours the solubilisation of fixed phosphorus. The higher values of potassium could be attributed to more intense weathering and upward translocation of potassium from lower deapth along the capillary raise of ground water ,this findings were in agreement with the findings of Srinivas et al.,(1998) and Sankarnarayana et al(2010).

Chapter – III: The Green & Safe Chemistry Laboratories

In statistical figures announced by AISHE for the academic year 2016 - 17 it is evident that in India about 89, 50,000 students study Chemistry and the quantity of Chemicals wasted is about 2,67,750 Kgs, the cost of which being Rs. 13,38,75,000. In the Chemistry laboratories of our college nearly one 1000 students perform practicals per year. Consequently there is considerable quantity of Chemical wastage and which in turn threatening the safety of the students, health of students and also contributing to environmental pollution in the college campus.

In view of the seriousness of the above problem the lecturers of Department of Chemistry have formed into **"Green & Safe Chem Labs"** committee. Dr. B. Anusha, HOD, Department of Chemistry is its convener. The prime objective of this committee is to strictly implement the policy of "**3Rs – Reduce – Reuse – Recycle and also measures for the Safety of the students"** in the Chemistry laboratories of our college.

I. REDUCE:

We have taken steps for minimizing the usage of Chemicals and Reagents in the day to daypracticals by implementing the following alternative approaches.

- In preparing derivatives and preparations only minimal quantities of reactants are taken. This also reduces the requirement of reagents and also the consumption of fuel.
- In volumetric analysis wherever feasible we are using titrant and titrand with 50% reduced concentrations.
- We are encouraging our students to use 5 ml test tubes in place of conventional 20 ml test tubes while doing qualitative Organic or Inorganic analysis.
- We are also encouraging our students to use 'Spot Test plates' for qualitative tests.

II. REUSE:

- We are collecting separately and reusing the preparations /derivatives prepared by a class of students, by giving them as sample for the qualitative detection of functional groups or Cation/Anions.
- We are collecting the left over volumetric analysis solutions from a batch of students and reusing them for next batch of students.
- We are collecting the left over chemical in Organic or Inorganic analysis in separately labeled bottles from a batch and reusing these Chemicals for the next batch of students.

III. RE-CYCLE:

- Even old stock of Chemical is also used at least for qualitative determinationsand no Chemical is discarded as trash.
- No bottle with Chemical is thrown out inside the college campus.

- The empty plastic/glass containers and broken glassware are sent to local re-cycling units.

IV. SAFE DISPOSAL OF CHEMICAL WASTES:

- The sinks are regularly cleaned to facilitate quick drainage of Chemicals from the lab.
- Students are strictly instructed not to drain Chemicals in ‘Red List’. Ex:
  a. Compounds of the following elements:- antimony, arsenic, barium, beryllium, boron,
  b. cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium,
  c. silver, tellurium, thallium, tin, titanium, uranium, vanadium and zinc.
  d. Organohalogen, organophosphorus or organonitrogen pesticides, triazine
  e. herbicides, any other biocides.

- The waste acid/alkaline solutions are collected in separately labeled bottles and these solutions are neutralized before letting them through the sink.
- The filter papers and other solid wastes collected from Chemistry labs are being dumped into a pit dug in a secluded place in the vicinity of Chemistry labs, for it to undergo biodegradation

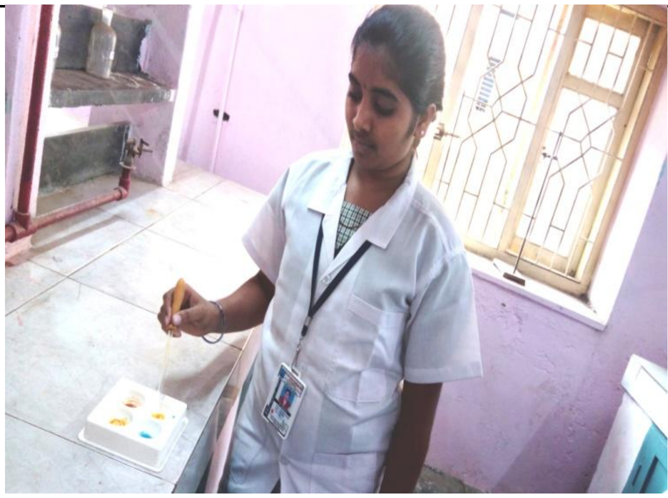
V. INITIATIVES TAKEN FOR SAFETY OF STUDENTS:

- We made it mandatory for every student to wear apron in the laboratory.
- A ‘First Aid Box’ with required medicines is kept awailable in the Chemistry laboratory..
- A ‘Fire Extinguisher is fixed in each of the two laboratories.
- **“Lab Safety Rules”** are written with paint on the inner walls of the two Chemistry Laboratories.

PHOTO GALLERY

TECHNIQUES ADOPTED TO REDUCE CHEMICAL USAGE

Students doing qualitative mixture salt analysis with 5 ml testubes.



Student performing qualitative tests for ions over a spot test plate.

Colour spot tests for Organic functional groups

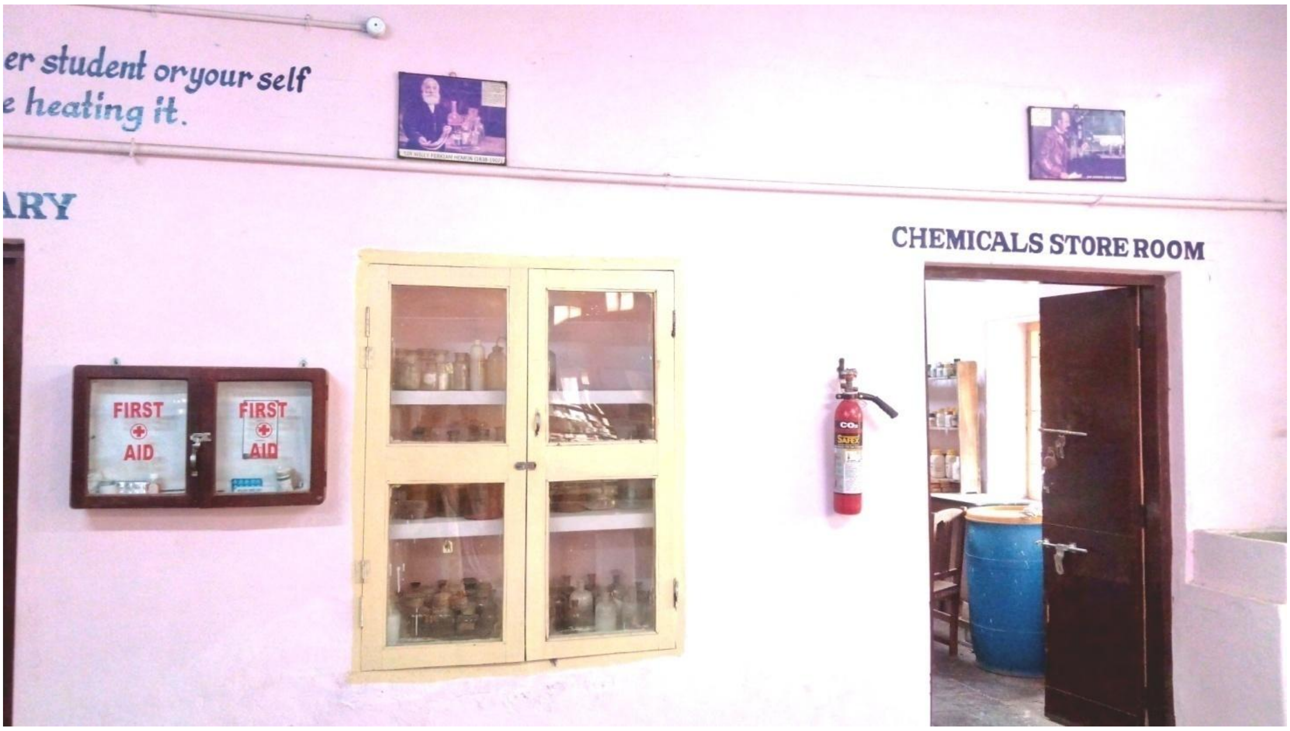
Colour spot tests for anions and cations

PHOTO GALLERY

SAFETY MEASURES IN CHEMISTRY LAB

Students wearing aprons in Chemistry Laboratory.

Safety rules displayed inside chemistry laboratory



FIRST AID box and Fire extinguisher in the Chemistry laboratory

Chapter – IV:**The Campus Solid Waste & E – Waste Management**

Solid waste:

The Vermi-composting is a method of preparing enriched compost with the use of earthworms. It is one of the easiest methods to recycle agricultural wastes and to produce quality compost. Earthworms consume biomass and excrete it in digested form called **worm casts.** Worm casts are popularly called as **Black gold.** The casts are rich in nutrients, growth promoting substances, beneficial soil micro flora and having properties of inhibiting pathogenic microbes.

Vermicompost is stable, fine granular organic manure, which enriches soil quality by improving its physicochemical and biological properties. It is highly useful in raising seedlings and for crop production. Vermicompost is becoming popular as a major component of organic farming system.

Vermicomposting materials

Decomposable organic wastes such as animal excreta, kitchen waste, farm residues and forest litter are commonly used as composting materials. In general, animal dung mostly cow dung and dried chopped crop residues are the key raw materials. Mixture of leguminous and non-leguminous crop residues enriches the quality of vermicompost.

There are different species of earthworms viz. *Eisenia foetida* (Red earthworm), *Eudriluseugeniae*(night crawler), *Perionyx excavatus*etc. Red earthworm ispreferred because of its high multiplication rate and thereby converts the organic matter into vermicompost within 45-50 days. Since it is a surface feeder it converts organic materials into vermicompost from top.

Types of vermicomposting

The types of vermicomposting depend upon the amount of producton and composting structures. Small-scale vermicomposting is done to meet the personal requirement and farmer can harvest 5-10 tonnes of vermicompost annually. While, large-scale vermicomposting is done at commercial scale by recycling large quantity of organic waste with the production of more than 50 – 100 tonnes annually

Process of vermicomposting

Following steps are followed for vermicompost preparation

- Vermicomposting unit should be in a cool, moist and shady site

- Cow dung and chopped dried leafy materials are mixed in the proportion of 3: 1 and are kept for partial decomposition for 15 – 20 days.

- A layer of 15-20cm of chopped dried leaves/grasses should be kept as bedding material at the bottom of the bed.

- Beds of partially decomposed material of size 6x2x2 feet should be made

- Each bed should contain 1.5-2.0 q of raw material . This is the kitchen waste collected from the college hostel .

- Red earthworm (1500-2000) should be released on the upper layer of bed .

- Water should be sprinkled with can immediately after the release of worms

- Beds should be kept moist by sprinkling of water (daily) and by covering with gunny bags

- Bed should be turned once after 30 days for maintaining aeration and for proper decomposition.

- Compost gets ready in 45-50 days .

- The finished product is $3/4^{th}$ of the raw materials used.

Harvesting

When raw material is completely decomposed it appears black and granular. Watering should be stopped as compost gets ready. The compost shout be kept over a heap of partially decomposed cow dung so that earthworms could migrate to cow dung from compost . After two days compost can be separated and sieved for use

Preventive measures

- The floor of the unit should be compact to prevent earthworms' migration into the soil.

- 15-20 days old cow dung should be used to avoid excess heat.
- The organic wastes should be free from plastics, chemicals, pesticides and metals etc.
- Aeration should be maintained for proper growth and multiplication of earthworms.
- Optimum moisture level (30-40 %) should be maintained
- 18-25^{O}C temperature should be maintained for proper decomposition.

Nutrient content of vermicompost

The level of nutrients in compost depends upon the source of the raw material and the species of earthworm. A fine worm cast is rich in N P K besides other nutrients. Nutrients in vermicompost are in readily available form and are released within a month of application.

Nutrient Analysis of Vermicompost

Parameters	*Content*
pH	6.8
OC%	11.88
OM%	20.46
C/N ration	11.64
Total Nitrogen (%)	1.02
Available N (%)	0.50
Available P (%)	0.30
Available K (%)	0.24
Ca (%)	0.17
Mg (%)	0.06

Advantages

There are many advantages of vermicompost :

- It provides efficient conversion of organic wastes/crop/animal residues.
- It is a stable and enriched soil conditioner.
- It helps in reducing population of pathogenic microbes.

- It helps in reducing the toxicity of heavy metals.
- It is economically viable and environmentally safe nutrient supplement for organic food production.
- It is an easily adoptable low cost technology.

Doses

The doses of vermicompost application depend upon the type of crop grown in the field/nursery. For fruit crops, it is applied in the tree basin. It is added in the pot mixture for potted ornamental plants and for raising seedlings. Vermicompost should be used as a component of integrated nutrient supply system.

Crops	***Dose/rate***
Field crops	5-6t/ha
Fruit crops	3-5kg/plant
Pots	100-200g/pot

Benefit

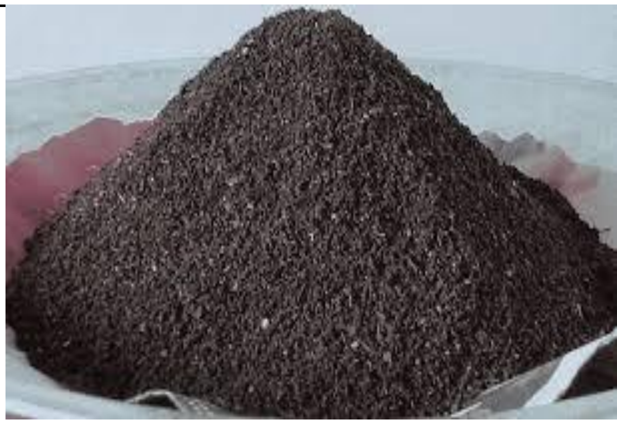
Vermicomposting is a highly profitable venture for organic farming and kitchen garden maintenance in the college. The approximate cost and benefit under different scale of production is given below.

Scale	App.cost per annum (Rs)	App.benefit per annum (Rs)	Cost/benefit ratio
Small	52,000	90,000	1: 1.73
Medium	1.0 lakh	1.85 lakh	1: 1.85
Large	2.25 lakh	4.5 lakh	1: 2.0

Thus the ‘Vermicomposting’ will be a source of income and at the same time the solid wastes are put to reuse. This practice also helps in maintaining the solid waste free and clean campus.

PHOTO GALLERY

Raw materials used for vermicomposting

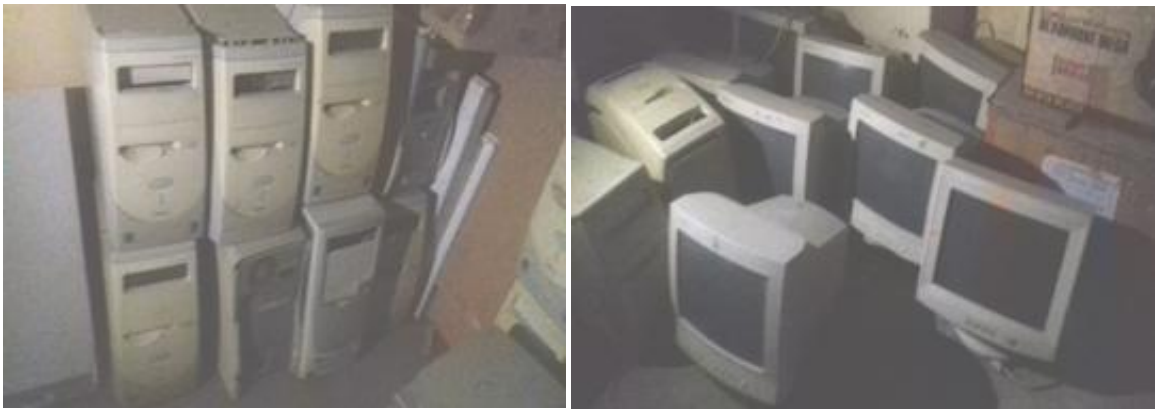


Vermicompost manure

E – WASTE MANAGEMENT:

In recent years the general usage of Computers, Computer accessories, CDs, DVDs, speakers, mouse, key boards, spikes, Air conditioners, spectrophotometers, digital appliances and other electronic devices and so on has enormously increased. It is quite natural that any electronic device works only for a stipulated period and after that it becomes unusable and irreparable. All such unusable electronic devices and their accessories are categorized as "E – waste". The main problem with E – waste is the problem of space. Storing becomes impossible when their quantity increases to unmanageable level. Hence their disposal becomes mandatory. But the aspect of boon is being that E – wastes could be put to re-cycling.

PHOTO GALLERY



Accumulated E-Waste

Chapter – 5: Conclusion

Thus through the "Green Audit" of the college campus, the following objectives get full filled.

- The information about the wide range of varieties of Plant kindom being grown in the college campus.
- Provides information on the extent of percentage of vegetation in the college campus.
- It provides information about the soil fertility and purity of water being used both in college and in hostels.
- The procedures adopted so as to keep college campus free from solid waste and their profitable management.
- Profitable management of E – waste by sending it for re-cycling.