

# 3 R'S: SMART PRACTICAL KITS

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**Abstract:** Generally Education system have practical labs and and the fields like science, Engineering and medicines require chemicals and they buy their chemicals from chemical distributors. But since last few decades the pattern have been changed as now many practical are based on semi-micro or micro level analysis/synthesis and require very small amount of chemical compounds But yet they have to buy the chemicals in bulk amount from the distributors as packing availability is always in terms of grams from 100 gm. to 500 gm. or even in 1kg. Once that practical gets over, that required chemical remains in the store room for next year. Sometimes even syllabus gets changed or that chemical gets expired or by some mean it gets wasted. Hence In our project, we have prepared a model of practical kits that contains on the required amount of chemicals and that will be provided by local distributors. And the money of educational institutions will be saved and even health problem of the person working with chemicals will be avoided and even the environmental pollution due to excessive use of the chemical also will be avoided.

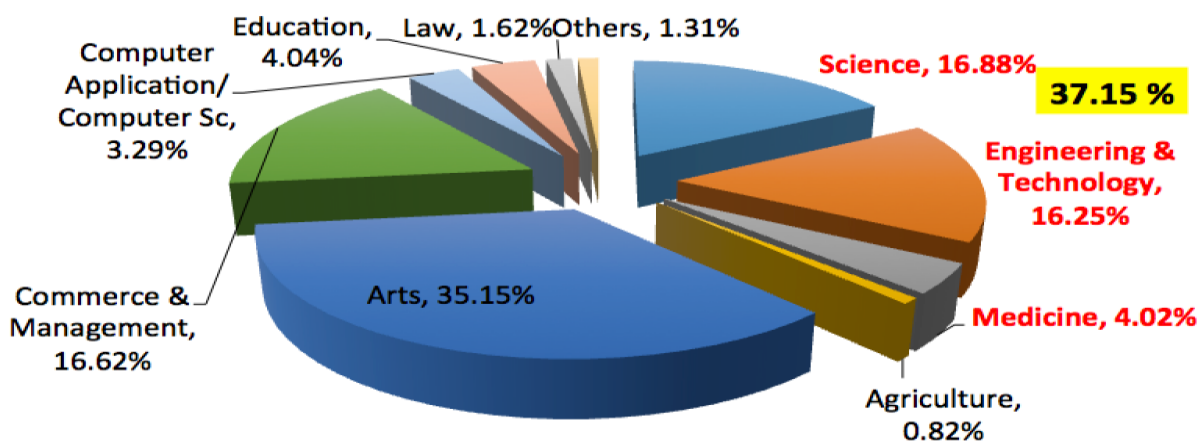
**Index terms:** Chemical, AISHE, Practical Kits, Environment.

## INTRODUCTION

Every science, Engineering and medical colleges and university has its own subject practical lab. Generally, subjects like chemical science, Life science and medical fields require certain chemicals for practical in their stream. Colleges and University buy these chemicals from the chemical distributors. Now the practical patterns have been changed since last decade and these practical are conducted to semi-micro and micro levels and bulk chemical has been avoided as that of before. But colleges and universities have to buy these chemicals in bulk from distributor. E.g. Chemical like phenolphthalein indicator, silver nitrate, mercurous chloride etc. have to buy in bulk from the distributor as packing available are always in grams from 100 gm. to 500 gm. or even in 1kg and for practical, they are require in very trace amount i.e. milligram to even ppm level. And packing is not available up to these concentration with Distributor and he may get very low margin of profit. It is found that syllabus changes every five years and the chemical bought may not be required for next syllabus and it get wasted and even get expires. As a consequence, these wasted chemicals may be thrown and arise environmental issues. Out of these chemicals many are hazardous like Nickel compounds which is carcinogenic.

**According to All India Survey of Higher Education (AISHE) - 2016-2017, there are 864 universities, 4026 colleges and 11,669 stand-alone institutions.**

## Percentage of Enrolments in different fields



Source: AISHE, 2016-2017

Dr Mrs. Vimal Rarh (Ref. 1) presented Brief summary below which shows wastage of money for the chemicals per year.

Total No of Enrolled Students in Higher Education	Total No of Enrolled Students in H.E = 3,57,00,000 (Three Crore Fifty Seven Lakh)
Total Percentage of Students having Chemistry as main or allied discipline	= 16.88 % (Science) + 16.25 % (Engineering) + 4.02 % (Medicine) = 37.15 %
Rounding off for Only Chemistry subject	25 %
Total Number of Students studying Chemistry in HE	25 % of 3,57,00,000 = 89,25,000
No. of Students studying Chemistry in Higher Education	89,25,000
Assumption: Wastage of chemicals per student per experiment	1 g
Wastage per student per year (Assumption: 30 experiments per year)	30 g
Approximate wastage Per Year	= 26,77,50,000 g = 2,67,750 Kg
Amount of money wasted per year (Assumption: Average cost of Chemicals = Rs 500 per Kg)	Rs. 13,38,75,000

Looking at this alarming statistics, it is our utmost obligation that we should look into this matter as our urgency. Educational institutions are contributing to such a lot amount of pollution and hence we should strictly obey to the guidelines and ensure minimal amount of environmental pollution from laboratory. We must develop good practices in labs like about chemical safety and safe disposal techniques. It is actually the responsibility of everyone who uses the laboratory but safe management of the chemicals begins mainly with the teacher who orders and uses these products. To ensure safe management of the chemicals in the classroom or in the lab it requires that a teacher must have adequate knowledge of these chemicals to be

used and what harmful interactions they can do in terms of the safety hazards and how they can be safely disposed.

Some harmful compounds used in chemistry laboratories are-

- ❖ Compounds of the following elements:- antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, tellurium, thallium, tin, titanium, uranium, vanadium and zinc.
- ❖ Organo-halogen, organo-phosphorus or organo-nitrogen pesticides, triazine herbicides, any other biocides.
- ❖ Cyanides
- ❖ Mineral oils and Hydrocarbons.
- ❖ Poisonous organo-silicon compounds, metal phosphides and phosphorus element
- ❖ Fluorides and nitrites

All above chemicals are harmful to living being at high concentration and even to the environment

### Methodology:

In our project, Smart practical kits were tried to make for graduate level practical for chemistry Subject.

Stream	Class	Total cost of chemicals requires (Rupees)	Total cost of kits (Rupees)
F.YB.Sc	Paper I	6021	1024
	Paper II	8000	3100
S.Y.B.Sc	Paper I	8421	3019
	Paper II	7560	4848
	Paper III	18000	9405
T.Y.B.Sc.	Paper I	24722	15447
	Paper II	38,589	7,893
	Paper III	13508	6779
	Paper IV	12240	6434

**Practical Kit for TYBSC Chemistry (Paper II) Semester V 2018.**

Exp. No.	Chemical Name	Market Price rupees	Required amount Price. Rupees
1.	Copper sulphate	565	30
	Potassium oxalate	532	80
	alcohol	400	30
2	Copper chloride	1495	75
	alcohol	400	50
	DMSO	1000	72
3	Ferrous sulphate	203	10
	Ethylene diammine	829	125
	Alcohol	400	100
4	Sodium methoxide	465	100
	Potassium dichromate	910	100
	Zinc dust	11000	2750
	alcohol	400	50
	<b>Total</b>	<b>18599</b>	<b>3572</b>

**Practical Kit for FYBSC Chemistry (paper-I) Sem-I 2018**

Sr.no.	Chemical Name	Price per 100 gm.	Required amount Price.
1.	Sodium hydroxide	170	39
	Ethyl acetate	319	76
	Phenolphthalein	150	36
2	Acetic acid	175	11
	Sodium acetate	460	36
3	Potassium permanganate	184	5

4	Borax powder	340	7
	Methyl red	542	5
	<b>Total</b>	<b>2340</b>	<b>343</b>



Photos of Practical Kit model.

### Advantages:

Easy to handle, Very Cheap, No chemical waste, Recycling, Less efforts whole year, Less pollution.

### Conclusion:

The prepared kit is very cheap. The Distributor has to unite at least four to five colleges. Need chemist to prepare the kit, Providing further jobs to under graduate students. It will reduce the chemical wastage cost of our country. It will reduce the pollution to certain extent. Lab accident chances will be minimum. The packaging materials can be reuse again and again. Distributor can provide kits to junior colleges, Industries etc.

### References

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