

Small Scale Chemistry

(Microscale Chemistry)

It's ~~not~~ easy being green.

What is it???

- A method of teaching and researching widely used at secondary and university schools working with small quantities of chemical substances.
- Uses milligrams instead of grams of chemical substances.
- Uses specialized equipment, for example micropipettes, microburettes, and microplates (chemplates).

What's in it for you?

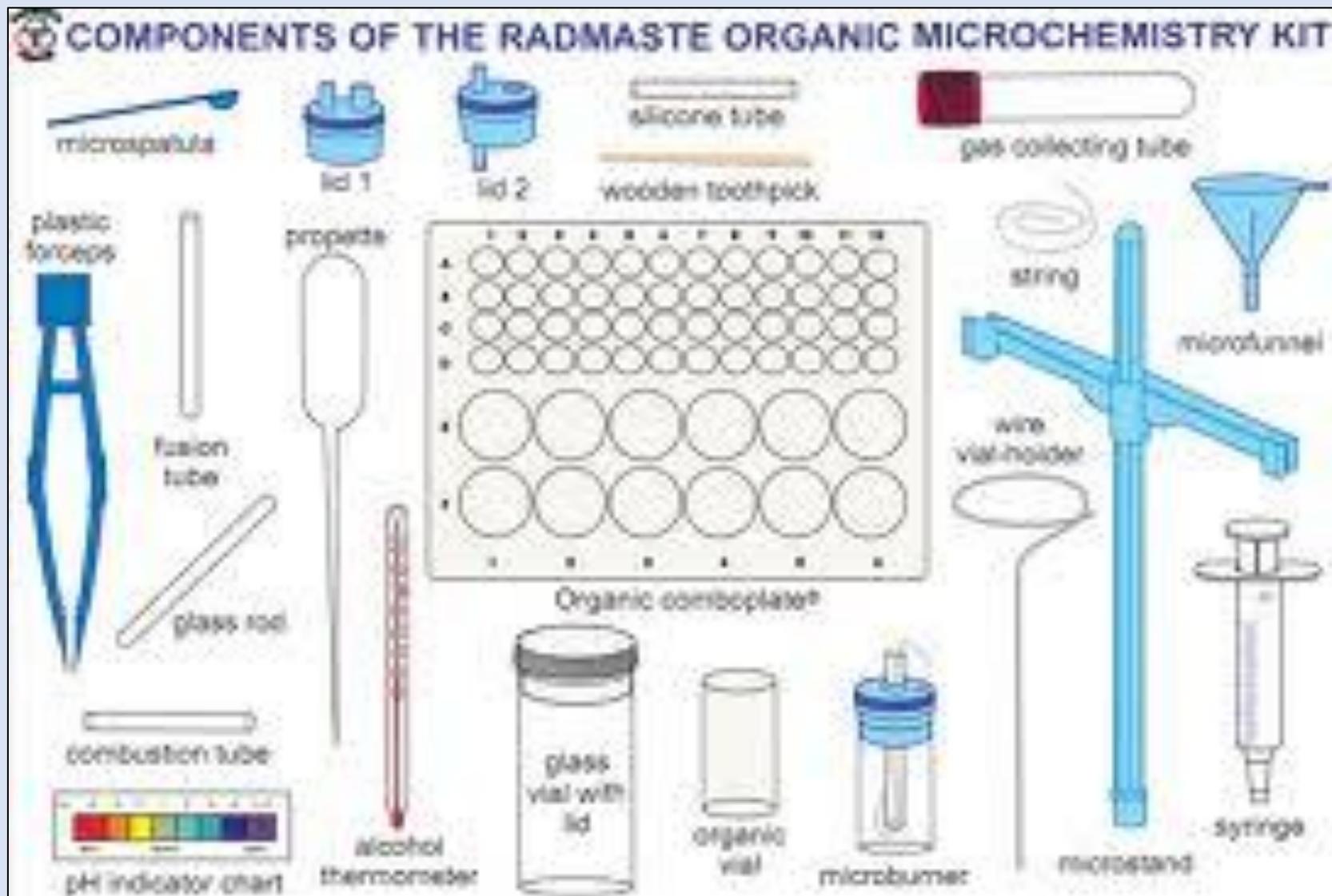
- Improves student dexterity, lab technique
- Improves their accuracy & precision
- Decreases waste
- Much less expensive – less equipment & chemicals
- Requires less storage space
- Decreases prep & clean-up time
- Less crowding on lab benches – pleasant working atmosphere
- Less hazardous – fewer chances for accidents
- Improves air quality – greatly reduces fumes
- Little or no hazardous waste disposal
- Shorter reaction times; more time for evaluation & discussion

Is small scale chemistry widely used?

“The Global Microscience Experiments Project, created by UNESCO in close cooperation with various international and national organizations, is well known throughout the world. Many teaching and learning materials on Microscience experiments covering primary sciences, chemistry, biology and physics have been prepared and are available free on the UNESCO website. These materials cover principally primary and secondary educational levels.”

United Nations Educational Scientific and Cultural Organization

Equipment



Organic synthesis apparatus for normal and microscale



Small Scale Acid Rain Lab

Video by Flinn Scientific

<http://www.youtube.com/watch?v=4Q6k822ISm4>

Examples of Small Scale Labs

Petri Dish Electrolysis

- Electrolysis of water on a microscale demonstrating a redox reaction
- Touches on logistics and efficiency of hydrogen fuel production using water electrolysis and acid-base indicators

Mystery Chemical Reactions

- In this guided inquiry lab, students react pairs of 10 known compounds in solution.
- They use what they learned in first activity to determine the identity of eight unknown chemicals.

- Carolina Biological Supplies

More Examples of Small Scale Labs

Measuring Boiling Point

- Measures the boiling point of acetone, ethanol and 1-propanol
- Identifies an unknown liquid by its boiling point.
- Correlates boiling point with molar mass and hydrogen bonding.

Comparing the Strengths of Acids

- Preparation of serial dilutions of standard acid solutions
- Measures the pH of the standard and diluted solutions
- Ranks the acids in order of strengths.

Uses less chemicals...



Comparison of Macro and Small Scale Results

	Macro	Micro	1/10 concentration
Conc. $\text{Na}_2\text{S}_2\text{O}_3$	0.1M	0.1M	0.01M
Bleach sample	1/10 dilution	1/10 dilution	1/100 dilution
Volumetric volume	250cm ³	25cm ³	25cm ³
Burette volume	25cm ³	2cm ³	2cm ³
Standard deviation	0.50-2.42	0.01-0.03	0.01-0.14
%w/v	3.82-4.30	4.40-4.57	3.78-4.21

Benefits of Teaching Using Microscale Chemistry

Video by Flinn Scientific

<http://www.youtube.com/watch?v=Gukqh9t4Mmc>