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Analytical Chemistry – The Hub To Chemistry – The Wheel

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(Written and compiled on his completing 1K (1000) months of living)

When a man is tired of Chemistry he is tired of his life since there is everything in chemistry that life requires, the requirements being, food, clothing and shelter, these 3 in turn are associated with materials, natural or man-made. Chemistry hence may be considered as the wheel. The branch of Science, Chemistry, chiefly is concerned with materials involving matter-matter and matter – energy interactions. Both these will result in new products more sought after by man for better living and life style as time passes. Have you got Purity (quality), quantity and cost benefit in getting the new product, if not go to Analytical Chemistry. It may not be out of place to recall two representative stories in this regard: Aristotle ‘s“Eureka” (in finding the purity of the King’s crown) and Haber’s Ammonia synthesis to augment the short supply of the basic agricultural input, namely, fertilizer to Germany, during the 1stWorld War.

Till 1888 Chemistry is Analysis and Analysis is Chemistry. Analysis till then is mostly empirical and largely experimental. The very recent article in ACT Newsletter, May-august, 2017 titled ‘Third eye of 21st Century Chemistry’ (TeCh)” by one of the computational chemistry experts, Prof. R. Sambasivarao, is an excellent review of chemistry topics from the angle of measurements and computations in a comprehensive bird’s eye way. The expression measurement is very closely linked to Analytical Chemistry, which has evolved from Aristotle’ Eureka to the latest computer controlled processes and computer based Data analysis leading eventually to KID (as outlined by Prof. Sambasivarao). Measurement and Computation are two basic aspects of analytical chemistry. Of late quality aspects crept into analytical measurements and data analysis. This led to introducing the 3R’s Readability, Repeatability and Reliability also as supplementary to sensitivity, selectivity and specificity. In order to keep abreast of the fast changing trends, we may have to refresh our knowledge of Analytical Chemistry. Let me go about this aspect in a concise and more compact manner. The first step is the definition of goal; representative examples to highlight this aspects are: gypsy moth devastation of farm land produce, fluoridation of water supply, motor oil/transformer oil to identify the wear and tear of the engine/transformer etc.,

To solve the problems faced the chemist must be prepared to use any part of information relating to chemistry and the tools of chemistry available at his disposal. To have the firsthand information and knowledge a chemist and an analytical chemist should strive to constantly and continuously update his

KID (Prof. Sambasivarao). This is one of the elements that the chemistry teacher, especially analytical chemistry teacher should bear in mind such that the aim of Association of Chemistry Teachers (namely, 'Promoting Excellence in Chemistry Education') is fulfilled. This is the basic difference between a chemist analyst and an analytical chemist. An analytical chemist is one who is a skills developer in the basic operations, measuring techniques, excellence in data analysis etc. etc, A chemist analyst on the other hand is one that scrupulously follows the already outlined technique irrespective of the result that is obtained. A striking way of presenting the connection between results and conclusions is given at as Annexure 1 at the end of this article, (page.3).

An analytical chemist should recognize that 3rd millennium/21st century objectives of chemical analysis shifted from:

- (i) One dimensional intent (Robert Boyle time,1604) to multidimensional one, Specificity to selectivity
- (ii) Single constituent (element/component) to > 2 constituents (elements/components)
- (iii) Mono discipline study to multidiscipline
- (iv) Single- variate to multi-variate
- (v) Parts per thousand to parts per trillion (macro to ultra-micro level)

This article presents the best possible manner within my ability outlining the importance of analytical chemistry to teachers interested in promoting excellence in chemical education. Let me now go about describing the Steps (operations) and categories of analytical techniques, again in the comprehensive way. STEPS: (a) sampling, (b) preparing the analyte for measurement (c) measurement (d) error recognition and data analysis. At this stage one should keep in mind the fact that each and every step and technique is associated with the Quality aspect.

Categories of techniques (Quantitative Analytical Chemistry)

Classical: volumetric (titrimetric); (a) Ion –electron reactions (redox reaction)

(b) Ion-ion, (Acid-base), (precipitation) (Complex formation)

(c) Ion-molecule

In conclusion the Analytical Chemist should be prudent enough to pay attention to the following:

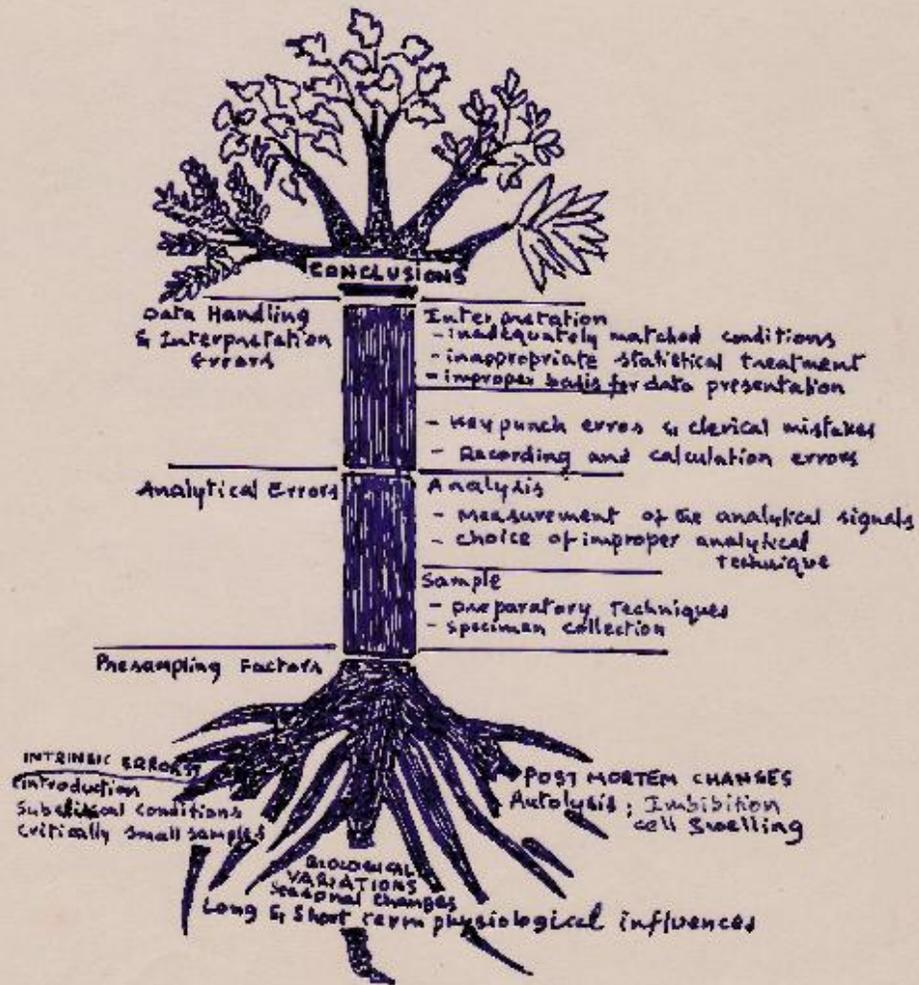
- (1) Selecting and using matrix true (or matrix matched) certified reference standards for comparison or calibration
- (2) Employing validated analytical methodology
- (3) Following standardized methodology
- (4) Entrusting the job to specially trained personnel, particularly in trace and ultra-trace level constituents.

Finally, in the end the author, Prof.UMK, greets all those that are connected with JOAC in some way and wishes them a long, happy, bright and prosperous life ahead, especially to Prof. Kaza Somasekhararao and his team that are running the Online Journal continuously and consistently.

Annexure 1

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A RELIABLE CONCLUSION
DEPENDS ON THE QUALITY OF THE
ANALYTICAL RESULTS ...



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