



## New developments in preparation and use of standard gas mixtures

M. Słomińska \*, P. Konieczka, J. Namieśnik



Chemical Faculty, Department of Analytical Chemistry, Gdansk University of Technology, G. Narutowicza Str. 11/12, 80-233 Gdansk, Poland

### ARTICLE INFO

#### Keywords:

Calibration  
Chemical metrology  
Diffusion  
Gas analysis  
Permeation  
Reference material  
Standard gas mixture  
Thermal decomposition  
Thermogravimetric analysis (TGA)  
Transfer technique for gas (TTG)

### ABSTRACT

Standard gas mixtures are commonly applied in all stages of analytical work related to the analysis of gaseous samples. Numerous techniques for generating standard gas mixtures are in use. In this article, we present new developments regarding the production of standard gas mixtures, with particular focus on improvements in the application of dynamic techniques for generating them. Furthermore, we describe the application of new techniques, such as thermal decomposition or transferring a small amount of gas.

© 2014 Elsevier B.V. All rights reserved.

### Contents

1. Introduction .....	135
2. Standard gas mixtures as specific reference materials .....	136
3. New developments in the production of standard gas mixtures .....	137
3.1. Diffusion and permeation .....	137
3.1.1. Diffusion phenomenon .....	137
3.1.2. Permeation phenomenon .....	138
3.2. Thermal decomposition of surface compounds .....	139
3.3. Technical improvements of systems for generating standard gas mixtures .....	139
3.3.1. Bubbler systems .....	139
3.3.2. Measurements of mass loss .....	140
3.3.3. Dilutions systems .....	141
4. Conclusion .....	141
Acknowledgment .....	142
References .....	142

### 1. Introduction

Theoretical and practical issues related to making measurements have accompanied humans since ancient times. They provided the foundation for creating metrology, which deals with the methods of measurement and the interpretation of measurement results.

Modern metrology is the answer to the human need to ensure the reliability of measurements. This necessity led to creation of a common, uniform system of measurement. The continuous

development of science and technology, and the need to assure that the measurements are independent of place and time, contributed to the creation of The International Bureau of Weights and Measures (BIPM) in Paris in 1875.

Following the idea of producing measurements that are independent of place and time, in 1888, the International Congress of Chemists in Chicago adopted a resolution, according to which “*Reference materials in analytical chemistry should play the same role as a meter in length measurements and kilogram in mass measurements*” [1]. This event became the driving force behind the development and the production of reference materials.

Chemical metrology is a relatively new science. The use of metrology in chemical measurements has taken on special significance in recent years. Fig. 1 shows the milestones in the development of metrology, with particular emphasis on chemical metrology.

\* Corresponding author. Tel.: +48 58 347-21-10, +48 58 347-21-94; fax: +48 58 347-26-94.

E-mail address: [korpala.m@poczta.onet.pl](mailto:korpala.m@poczta.onet.pl) (M. Słomińska).

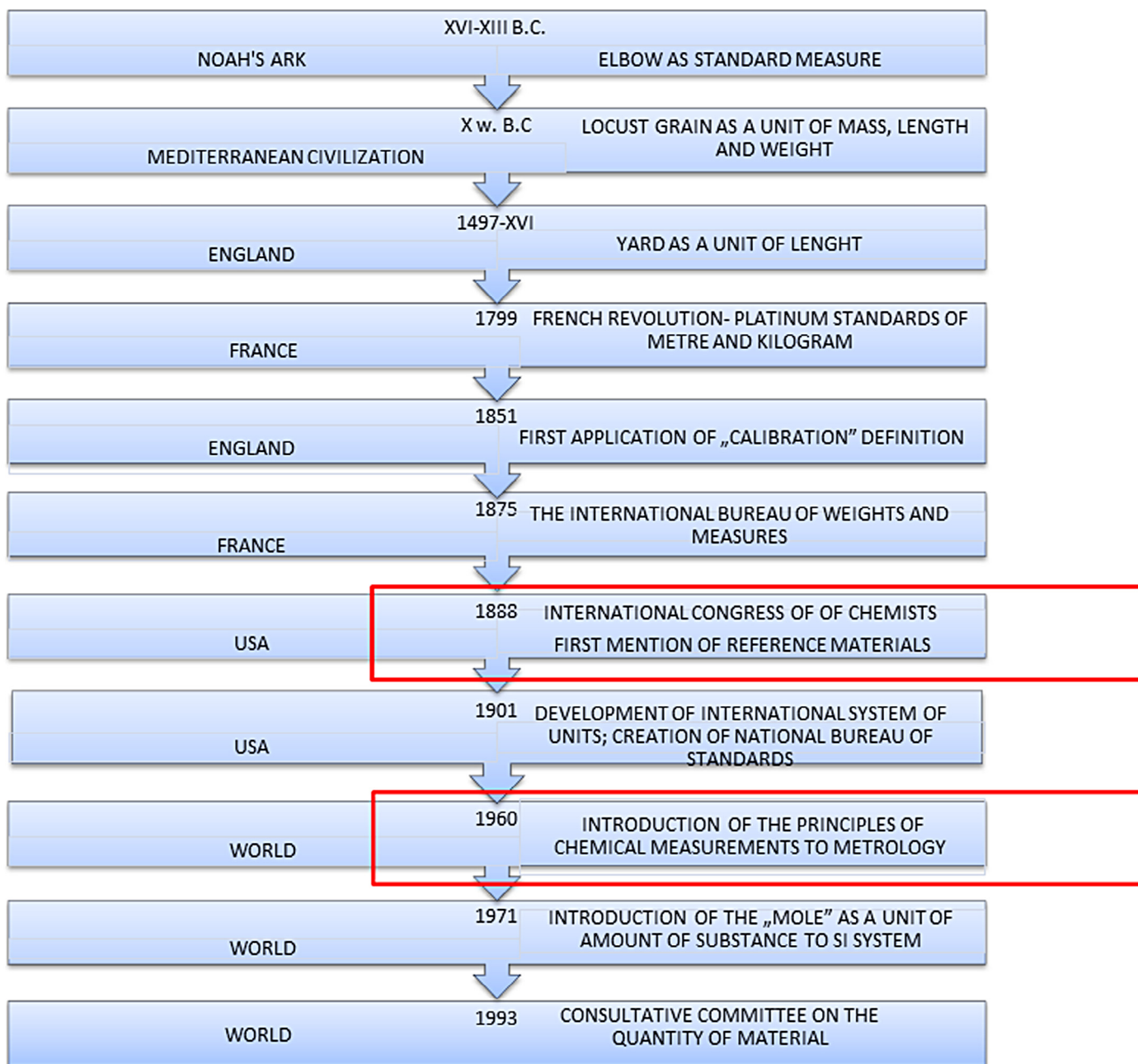


Fig. 1. The milestones in the development of metrology, with emphasis on chemical metrology.

The reliability of the results obtained from analytical measurements of the physical and chemical properties of tested materials has an impact on industrial and technological development.

In order to apply the principles of metrology to chemical measurements, it is necessary to create the appropriate quality-control and quality-assurance (QC/QA) system, which includes [2–5]:

- (1) ensuring traceability;
- (2) estimation of uncertainty;
- (3) validation of analytical procedures;
- (4) use of reference materials; and,
- (5) participation in inter-laboratory comparisons.

Reference materials with different metrological characteristics play a key role in this QC/QA system.

## 2. Standard gas mixtures as specific reference materials

A reference material is defined as “material sufficiently homogeneous and stable with reference to specified properties which has been established as fit for its intended use in measurement or in examination of nominal properties” [6].

Standard gas mixtures comprise definite amounts of analyte and diluting gas; they are characterized by a stable concentration of components, known sources of errors and high availability. Standard gas mixtures are a specific type of reference material. Taking into account the chemical composition of standard gas mixtures, they can be divided into two groups (i.e., matrix and non-matrix reference materials).

A non-matrix reference material is a controversial term, which very often generates difficulties in assigning a specific reference

Download English Version:

<https://daneshyari.com/en/article/1249104>

Download Persian Version:

<https://daneshyari.com/article/1249104>

[Daneshyari.com](https://daneshyari.com)