INDONESIAN EXPERIENCE IN PROVIDING ACCURACY-BASED PROFICIENCY TESTING SCHEME USING METROLOGICALLY TRACEABLE REFERENCE VALUES FOR ELEMENTS MASS FRACTION IN DRINKING WATER

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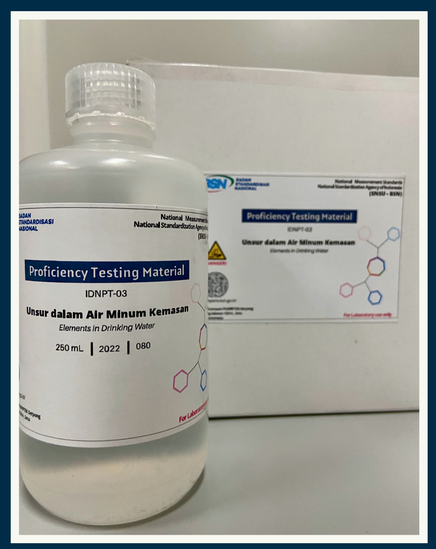
INTRODUCTION

The National Metrology Institute of Indonesia, National Measurement Standard, National Standardization Agency (SNSU-BSN) through the Laboratory of SNSU for Inorganic Chemistry has conducted an accuracy-based Proficiency Testing (PT) scheme for the mass fraction of Arsenic (As), Cadmium (Cd), Copper (Cu), Nickel (Ni), and Zinc (Zn) in bottled drinking water matrices based on ISO/IEC 17043:2010. The aim of the PT scheme was to evaluate laboratory capability in measuring minerals and contaminants in drinking water to comply with the implementation of Indonesian National Standard SNI 3553:2015 and the Regulation of Indonesian Ministry of Health No. 492/2010 regarding quality requirements of mineral and drinking water.



METHODS AND PT EVALUATION

The PT material was a candidate of certified reference material which was prepared by spiking a known weight of analytes into commercially bottled drinking water. The testing of homogeneity and stability on the material was performed and evaluated according to ISO 13528:2015 and ISO Guide 35:2017. Metrologically traceable reference values were used as the PT-assigned values (X_{PT}), while the standard deviation for proficiency assessment (σ_{PT}) was derived from the Horwitz model. The robust mean (x*) and standard deviations (s*) were also determined by Algorithm A with an iterated scale as a comparison.

Table 1. Summary of statistic and techniques used in the PT scheme

Analyte	X_{PT}	$u(X_{PT})$	σ_{PT}	x*	s*	Unit	Characterization Technique	Traceability to SI through
As	8.41	0.14	1.85	13.51	10.75	µg/kg	GSA*	SRM 3103a
Cd	3.06	0.07	0.67	5.97	4.05	µg/kg	IDMS**	SRM 3108
Cu	220.8	4.1	44.3	228.7	42.4	µg/kg	IDMS**	SRM 3114
Ni	60.7	1.0	13.3	56,8	12.3	µg/kg	IDMS**	SRM 3136
Zn	451	13	81	506	92	µg/kg	GSA*	SRM 3168a

*GSA: Gravimetry Standard Addition
**IDMS: Isotope Dilution Mass Spectrometry

There were 22 participants from testing laboratories in Indonesia that participated and reported their measurement results. The performance of the participants was evaluated mainly against the reference value based on z-scores and based on zeta-scores for their claimed uncertainty as additional information. The measurement method used by participants were diverse, from Inductively Coupled Plasma – Mass Spectrometry (ICP-MS), Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES), to Graphite Furnace - Atomic Absorption Spectroscopy (GF-AAS), Flame - AAS (F-AAS) and Hydride Generation – AAS (HG-AAS).

PT RESULTS

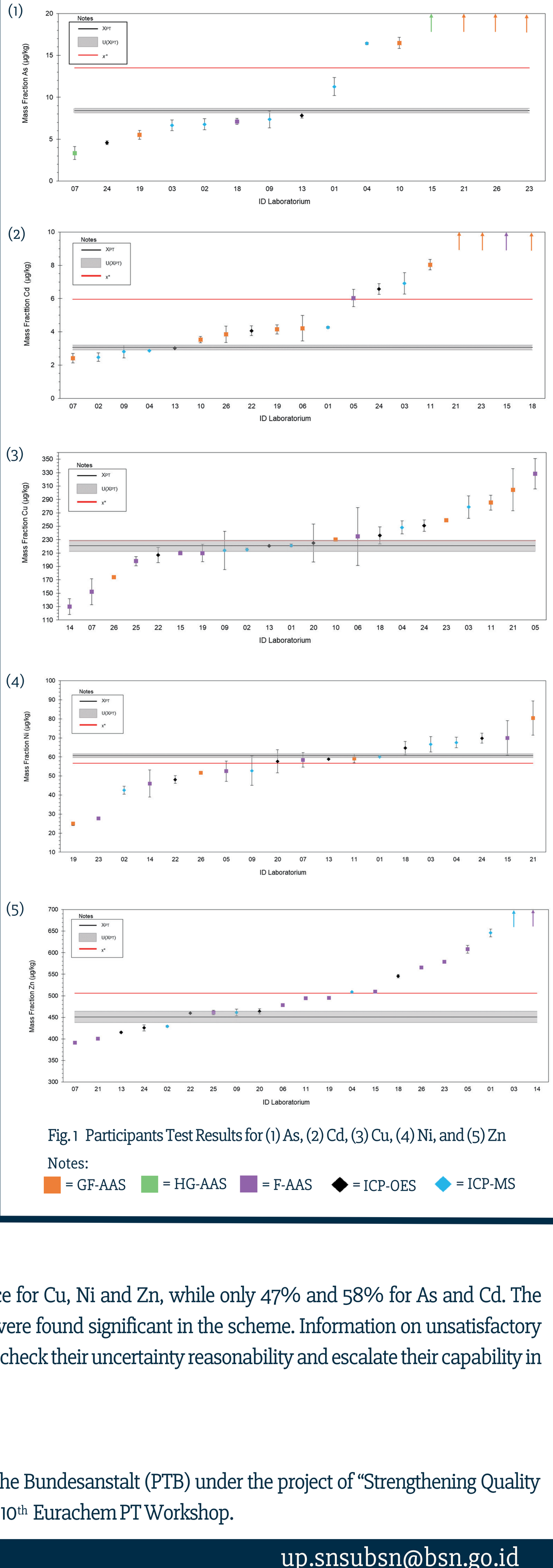


Fig. 1 Participants Test Results for (1) As, (2) Cd, (3) Cu, (4) Ni, and (5) Zn

Notes:
= GF-AAS = HG-AAS = F-AAS = ICP-OES = ICP-MS

SUMMARY

The PT results showed that more than 80% of participants obtained satisfactory performance for Cu, Ni and Zn, while only 47% and 58% for As and Cd. The differences between the reference values and the robust mean of participants for As and Cd were found significant in the scheme. Information on unsatisfactory performance of laboratories within their claimed uncertainty means the laboratories need to re-check their uncertainty reasonability and escalate their capability in the uncertainty estimation for further enhancement.

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