

# Analysis of inorganic impurities in illicit methamphetamine using Inductively Coupled Plasma Mass Spectrometry (ICP-MS)

---

SUNGILL SUH<sup>1</sup>, BEOM JUN KO<sup>1,2</sup>, YONG JUN SUH<sup>1</sup>, and MOON KYO IN<sup>1</sup>, SUNG-HONG KIM<sup>3</sup>

<sup>1</sup> Drug Signature Analysis Center, Supreme Prosecutors' Office, Seoul 137-730, Korea

<sup>2</sup> School of Agricultural Biotechnology, Seoul National University, San 56-1, Sillim-dong, Gwanak-gu, Seoul, 151-742, Korea

<sup>3</sup> Korea Basic Science Institute, Daegu branch, 1370, Sankyuk-dong, Puk-gu, Daegu, 702-701, Korea

**AIMS:** In most illicit methamphetamines of Korea, ephedrine or pseudoephedrine is detected as organic impurity. Therefore it is thought that the methamphetamines are synthesized by Nagai method and Emde method, in which ephedrine or pseudoephedrine is used as a starting material. Using the organic impurity analysis results of illicit methamphetamines, methamphetamines seized in Korea had been divided into 4 types; Nagai type which has characteristic impurities of Nagai method, Chloroephedrine type which has characteristic impurities of Emde method, Undetermined I type which has noncharacteristic impurities, and Undetermined II type which has few impurities. The purpose of this study is to get additional information for the illicit methamphetamine classification by inorganic impurity analysis.

**METHODS:** Out of total 51 samples analyzed, 16 samples were of Nagai type, 26 samples of Chloroephedrine type, 3 samples of Undetermined I type, and 6 samples of Undetermined II type. The methamphetamine samples were quantitatively analyzed using ICP-MS over 25 elements. A Perkin Elmer model Elan 6100 ICP-MS was used.

**RESULTS:** Iodine was detected in 14 samples of Nagai type and 2 of Undetermined II type. Iodine was detected in almost all Nagai type methamphetamines. This result is compatible with Nagai method using HI and red phosphorous as reduction reagents. Palladium or barium was detected in 18 samples. 17 samples were of Chloroephedrine type and 1 of Undetermined II type. The origin of palladium or barium can be attributed to Pd/BaSO<sub>4</sub>, the reductive catalyst in Emde method. Bromine was detected in 29 samples; 22 samples were of Chloroephedrine type, 3 of Nagai type, 1 of Undetermined I type, and 3 of Undetermined II type. There were 5 of the 29 samples in which both bromine and iodine were detected. 3 of the 5 samples were of Nagai type, and 2 of Undetermined II type.

**CONCLUSIONS:** Inorganic impurity analysis of illicit methamphetamines was carried out using ICP-MS. Iodine was detected in most of the Nagai type methamphetamines, and palladium or barium was detected in two thirds of the Chloroephedrine type methamphetamines. These results of inorganic analysis quite match with the organic impurity analysis. Bromine seems to be a meaningful element, but it needs more studies for a useful understanding of bromine detection. The analysis of inorganic impurities in illicit methamphetamine was proved to be helpful for the organic impurity analysis.

**KEYWORDS:** *Methamphetamine, Impurity analysis, ICP-MS*

**Corresponding author:** [sung72@spo.go.kr](mailto:sung72@spo.go.kr)