



### D23 Characterization and Profiling of Illicit Methamphetamine Tablets Abused in Singapore

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The goal of this presentation is to provide law enforcement agencies with information in establishing possible links between different seizures of illicit methamphetamine tablets.

**Outcome:** Based on the methamphetamine content, the major components found and the minor impurity profiles, it is possible to classify the illicit methamphetamine tablets into groups for the purpose of providing a link between these tablets. Adopting an impurity profiling method similar to that of UNDCP Laboratory enables the laboratory to compare its results with those of UNDCP and other studies to shed some light on the origins of the illicit methamphetamine tablets abused in Singapore.

The abuse of methamphetamine in Singapore has been on the rise since mid 1997. While many of the exhibits submitted to the laboratory are in the crystalline form as methamphetamine hydrochloride, known commonly by its street name "ice," a significant number of the methamphetamine exhibits are in the form of tablets.

Most of the illicit methamphetamine tablets are believed to be manufactured in the "Golden Triangle" region and smuggled into the country. They have multi-colors and logos and are easily confused with the "Ecstasy" tablets that are also being abused in the country. This paper will present the results of a study undertaken by the laboratory on the char-

acterization and profiling of the illicit methamphetamine tablets. While it may be difficult to identify the possible sources of these tablets since they are manufactured outside the country, it is hoped that the information will be useful to law enforcement agencies in establishing possible links between the different seizures and identifying the distribution networks.

Approximately 200 samples of methamphetamine tablets were used in the study. These tablets were collected over a period of about 4 years, from 1998 to early 2002. Based on the methamphetamine content and the major components found, the tablets could be broadly divided into 2 groups. The first group of tablets had a methamphetamine content ranged from 3% to 29% and usually contained caffeine as the only other major component. This group of tablets came with few colors and only 2 logos were seen so far. The second group of tablets had a methamphetamine content varied from less than 1% to about 11% and consisted of tablets with a great variety of colors and logos. They generally contained several other major components other than methamphetamine. Components found so far included caffeine, diazepam, ketamine, dextromethorphan, ephedrine (or pseudoephedrine), lignocaine, midazolam, paracetamol, and triprolidine. Of these, caffeine and ketamine were the most commonly found. Many of these components were present at a much higher concentration than methamphetamine.

A detailed impurity profiling study was conducted on the first group of the methamphetamine tablets since they have relatively simple composition and are usually being trafficked in large numbers. The method of impurity profiling adopted by the laboratory was based on that reported by the United Nations International Drug Control Programme (UNDCP) Laboratory.<sup>(1)</sup> It involves dissolving the powdered sample in a phosphate buffer solution at pH 10.5 and extracting the solution with ethyl acetate. The extract was then analyzed by GC/FID and GC/MS using n-tridecane, diphenylamine, and n-tetacosane as the internal standards. Using this method, the impurity profiles of a total of 46 samples were studied. The results show that over the years from 1998 to 2002, the main impurities found in this group of tablets appeared to be similar. Some of the common impurities found were benzaldehyde, 1,2-dimethyl-3-phenylaziridine, amphetamine, N-acetylmethamphetamine, N-formylmethamphetamine, ephedrine, N-acetylephedrine, acetyl-codeine, codeine and ethyl vanillin. Of the common impurities, codeine and acetylcodeine appeared to be not related to the manufacturing process. They were likely to be contamination from utensils from premises that were also used in the manufacturing of heroin. In the case of ethyl vanillin, it was probably added as a flavoring agent.

To have a better understanding of the synthetic route used in the clandestine manufacturing of methamphetamine, the optical purity of the compound in 26 samples was determined using GC/FID fitted with a chiral column. The results show that in all samples, only the more potent *d*-methamphetamine was found indicating that either the optically pure *l*-ephedrine or *d*-pseudoephedrine was used as the starting material.

An impurity profiling study was also carried out on selected samples of the second group of methamphetamine tablets which had higher methamphetamine contents (8-11%). In addition to the major components described earlier, some minor impurities found were benzaldehyde, amphetamine, N-formylmethamphetamine, MDMA, and 1-(3,4-methylenedioxyphe-nyl)-2-propanol.

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### **Methamphetamine, Impurity, Profiling**