Physico-Chemical Profiles of Methamphetamine Tablets

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ABSTRACT

Increases in abuse of methamphetamine tablets (known as "Yaba") have been reported throughout the past decade and today, the problem of methamphetamine abuse in Thailand is recognized as massive. It is accepted that Thailand is a major hub for drug trafficking and has the highest methamphetamine abuse rates in the world. Most methamphetamine samples collected in this region are in tablet form. Research into the tests, used in the legitimate pharmaceutical industry for quality assurance procedures, has resulted in an identification of various techniques applicable to the profiling of illicit drugs in tablet form. This opens the possibility that highly-detailed physical and chemical profiling of illicit methamphetamine tablets could be carried out with the resulting data which help identify the techniques of methamphetamine tablet manufacture in clandestine laboratories. This study investigated an in-vitro testing of physical and chemical properties of methamphetamine tablets. The goal of this study was to develop drug profile data which would be helpful to enhance the understanding of clandestine methamphetamine laboratories that spread throughout Thailand. Two-hundred-and-ninety-eight methamphetamine tablet samples, seized by the police in the northern region of Thailand during the period October 2003 - May 2004 were used in this study. The samples display 7 kinds of logos. Regarding logos, wY predominated followed by wy, WY, R, Wy, OK and 888 in decreasing prevalence. The average weight of all samples was 0.0914 ± 0.007 gm. The average diameter was 6.019 ± 0.004 mm. The average thickness was 3.027 ± 0.136 mm. Average methamphetamine and caffeine content were 21.76 ± 6.39 mg % and 62.43 ± 9.15 mg %, respectively. Significant difference ($p<0.05$) in diameter of methamphetamine tablets was found between each logo, notably between wY logo and wy logo. Thus, it seems probable that these two logos come from different manufacturers. As wY logo and wy logo tablets are the most popular tablets found in this region, it could be that two separate logo-producing groups are in fact the main methamphetamine manufacturers, distributing methamphetamine tablets in this region: the United Wa State Army (UWSA) could be the main methamphetamine-producing group, followed by the Shan United Army (SUA) or the former Khun Sa Army.

Key words: Physical property, Chemical property, Methamphetamine tablets

Two-hundred-and-ninety-eight samples were comprised of tablets, displaying 7 kinds of logos (Figure 1): wY (209 samples), wy (47 samples), WY (15 samples) , R (13 samples), Wy (12 samples), OK (1 sample) and 888 (1 sample). The samples with OK and 888 logo were rejected from the study because of a small number of samples. The average physical properties are shown in Table 1.

Table 1. Physico-chemical properties of methamphetamine tablets classified by logos.

Logo	Weight ± SD (gm)		Diameter ± SD (mm)		Thickness at Center ± SD (mm)		% methamphetamine		% caffeine	
	average	%CV	average	%CV	average	%CV	average	%CV	average	%CV
WY	0.0923 ± 0.0046	4.98	6.034 ± 0.007	0.12	3.032 ± 0.134	4.42	20.62 ± 7.61	36.91	62.43 ± 11.11	17.80
Wy	0.0889 ± 0.0024	2.70	6.045 ± 0.007	0.12	2.985 ± 0.007	0.23	17.70 ± 1.35	7.63	70.87 ± 4.22	5.95
wY	0.0910 ± 0.0071	7.80	6.012 ± 0.004	0.07	3.029 ± 0.135	4.46	22.00 ± 6.36	28.91	62.15 ± 9.36	15.06
wy	0.0931 ± 0.0057	6.12	6.054 ± 0.005	0.08	3.016 ± 0.148	4.91	21.16 ± 6.43	30.39	62.98 ± 7.33	11.39
R	0.0887 ± 0.0024	2.71	6.007 ± 0.001	0.02	3.073 ± 0.104	3.38	19.54 ± 3.33	17.04	69.91 ± 1.57	2.25
total	0.0914 ± 0.007	7.66	6.019 ± 0.004	0.07	3.027 ± 0.136	0.45	21.76 ± 6.39	29.37	62.43 ± 9.15	14.66

Methamphetamine and caffeine were found to be the main ingredients in methamphetamine tablets. The average content of methamphetamine and caffeine is shown in Table1. From data analysis using ANOVA, it was found that diameters of methamphetamine tablets were significantly different ($p< 0.05$) across logos (Tables 2,3) and wY logo and wy logo showed significant differences in diameter, using Tukey ($p< 0.05$).

Table 2. Results of an ANOVA analysis of the physical and chemical properties of the methamphetamine tablets studied. (*p<0.05).

Source of variation	F	P-value
Diameter	7.998*	0.000
Thickness	0.219	0.928
Weight	1.075	0.369
%Methamphetamine content	0.590	0.670
% Caffeine content	1.018	0.399

Table 3. Results of an ANOVA analysis of the study on diameter of the methamphetamine tablets studied (*p<0.05).

Source of variation		Sum of Squares	df	Mean Squares	F	P-value
Diameter	Between groups	6.869E-02	4	1.717E-02	7.998	0.000
	Within groups	0.616	287	2.147E-03		
	Total	0.685	291			

INTRODUCTION

It is widely accepted that illicit drug trafficking and abuse are international problems. The production of methamphetamine has increased dramatically in Southeast Asia over the past decade. It is estimated that the bulk of world production of methamphetamine now takes place in this region. Methamphetamine produced in Southeast Asia mainly comes from Myanmar. In fact, Myanmar produces up to 80 percent of the methamphetamine tablets that are consumed in Thailand. In general, abuse of stimulants has increased significantly and visibly in Thailand. In particular, methamphetamines now comprises of nearly 70 percent of all addictions to illegal substances in Thailand. The widespread availability of methamphetamine in Thailand is reflected in terms of increasing numbers of methamphetamine seizures, arrests, indictments and sentences. Northern Thailand remains an important route for methamphetamine trafficking from Myanmar, with drugs shipped into Thailand for domestic consumption, as well as drugs shipped with intent to reshipping outward to foreign destinations. There have been for some time a flow of reports on increasing number of seizures in Europe, the USA and Australia of methamphetamine tablets originating in Thailand and Myanmar (United Nations Office on Drugs and Crimes, 2004). In February 2003, the Thai Government declared a “war on drugs.” This war seemed to produce some results, as domestic methamphetamine seizure cases decreased one-third from the year 2002 to 2003 (Office of Narcotics Control Board, Thailand, 2004) . However, methamphetamine is still the main illicit drug, linking with problems in Thai society.

The drug-trafficking groups operating within Myanmar are mostly insurgent factions that have been warring with the Government of Myanmar and among themselves for many years. The trafficking groups that have historically refined heroin now also produce methamphetamine and the laboratories for both substances are often co-located. The main insurgent groups involved in the drug-trafficking business are the United Wa State Army (UWSA), the Shan United Army (SUA), also known as the Mong Tai Army or former Khun Sa Army and the Myanmar National Defence Alliance Army (Kokang Chinese), also known as the Burma National Democratic Front (U.S. Drug Enforcement Administration, 2002).

In Asia, methamphetamine is sold in both tablet form and crystal form. Tablets predominate in Thailand. Physical and chemical profiling, particularly of seized methamphetamine tablets (the tablet form possesses more suitable features for characterization than the crystal form) can result in the generation of a finely-detailed picture of their physico-chemical characteristics which will help in the delineation of both production and distribution processes for these tablets. Gaining enhanced understanding of production processes and a clearer picture of distribution networks will help in the fight against the spread and consumption of illicit methamphetamine tablets. In this context, the purpose of this study was to assess the potential of physical and chemical testing to provide strategic and tactical information useful in identifying the sources of methamphetamine tablets.

MATERIALS AND METHODS

A total of 298 methamphetamine multi-tablet samples, seized by the police authorities in the northern region of Thailand during October 2003–May 2004 were received and used in this study. The physico-chemical analyses required were conducted, using a combination of techniques. Dimensions were measured by a digital caliper. Dimensions measured were diameter and thickness at the middle of the tablet. Ten tablets were taken at random from each set of samples and measured to arrive at average dimensions. An analytical balance (AND, HM-200, Japan) was used to weigh the samples. Twenty tablets were selected at random and weighed to determine the average weight. Gas chromatography procedures were used to determine the qualitative and quantitative composition of the drugs and their adulterants (United Nations, 1987).

Sample preparation for gas chromatographic analysis

From each seized package of methamphetamine tablets, 10 tablets which appeared to have the same visual characteristics were selected. After the tablets had been ground into powder, 50 mg of powdered sample was dissolved and volume was then adjusted to 10 ml with 0.5 mg/ml diphenylamine in methanol. After that 1 μl was injected into GC for analysis. Diphenylamine was used as an internal standard.

Standard compound preparation for gas chromatographic analysis

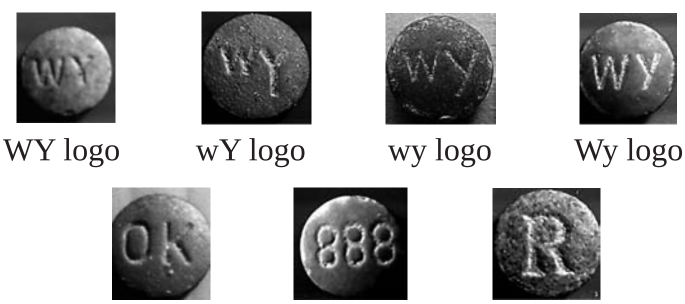
Reference standard compounds used in this study were amphetamine sulphate, methamphetamine hydrochloride, ephedrine sulphate, caffeine phosphate, paracetamol and phenacetin. All standard compounds were supplied by the Drug and Narcotic Institute, Department of Medical Sciences, Ministry of Public Health, Thailand. Ten mg of each standard compound was dissolved and adjusted in volume to 10 ml with 0.5 mg/ml diphenylamine in methanol, and then 1 μl was injected into GC for analysis.

The conditions of gas chromatography

The gas chromatographic analysis was carried out on a Chrompack CP 9002, Netherland, Gas chromatograph equipped with a flame ionization detector. Injection of samples was made at the split ratio 20:1, using a Chrompack CP 9050 autosampler with a fused-silica capillary column (30m, 0.32 mm i.d., film thickness 0.25 μm, Chrompack, Netherlands). The injector temperature was 260˚C and detector temperature was 280˚C. The oven temperature was programmed as follow: initial temperature, 130˚C; initial hold, 2 min; temperature program rate, 15˚C /min; final temp, 280˚C and final hold, 10 min. The carrier gas was nitrogen at a flow rate of 2 ml/min. Data-processing software (Maestro Chromatography Data System, Chrompack) was used for retention time, compensation of gas chromatogram and peak integration.

RESULTS

Figure 1. Various methamphetamine logos in samples collected.



WY logo wY logo wy logo Wy logo

OK logo 888 logo R logo

DISCUSSION AND CONCLUSION

Methamphetamine problems have hit Thai society hard for a past decade. The majority of methamphetamine spread in Thailand is tablet form. The characters of methamphetamine tablets from Southeast Asia, especially logo are quite unique. However, methamphetamine logos change from time to time. The study in 2002 showed that most popular logo was WY (in four variants), followed by R, OK, 888 and Ã/99. The four variants of WY logo observed were wY, WY, wy, Wy. wY predominated followed by WY, wy and Wy (Adam et al., 2004). In this study, WY was also found to be the most popular logo (in four variants), followed by R, OK and 888. wY still predominated, followed by wy, WY and Wy. Information from intelligence sources indicates that each manufacturer has a specific logo, for instance, wY is produced by the United Wa State Army (UWSA). WY is connected with the Myanmar National Defence Alliance Army (Kokang Chinese). wy, Wy is the mark associated with the Shan United Army (SUA) or former Khun Sa Army (Northern Narcotics Control Office, Thailand, 2001). The UWSA is the largest drug-producing and-trafficking group in Southeast Asia, producing heroin and methamphetamine. UWSA produces methamphetamine tablets embossed with the wY and 99 logos .When they first appeared, these logos were seen as being at the high end of quality for methamphetamine tablets. However, over the past several years, other trafficking groups have been counterfeiting these logos. Some sources assert that any one clandestine laboratory may produce methamphetamine tablets with a variety of logos. From the present study, tablets with wY logo and with wy logo were in the top two ranks. It could be proposed that the tablets produced by UWSA are the most popular, followed by tablets produced by SUA and Kokang Chinese group, respectively.

The study of physical characteristics of methamphetamine tablets has the potential to yield key information about the manufacturing machines used to produce these illegal methamphetamines. The tablets with WY, wy, wY and R logo showed greater variation in thickness and weight than did other tablet logo groups. The weight of the tablet is determined by the volume of the material which fills the die cavity and depends on the granule size and the void space. Therefore, the ability of the granulation or particles to flow freely into the die as well as continuousness of movement of the granulates from the source of supply or feed hopper are important in insuring a uniform fill. Variation in tablet thickness can indicate formulation or processing problems. At a constant compression load, variations in tablet thickness are indicative of changes in die fill and consequently, tablet weight, whereas with a constant die fill, thickness variation reflect changes in compressive force (Gordon et al., 1990). The diameter and shape of the tablets depend on the die and the punches selected for the compression of the tablet. As there is a significant difference between diameters of methamphetamine tablet bearing the wY logo compared to those with the wy logo, it is reasonable to infer that the size of punches and dies for the compression of the tablets with wY logo and those for the wy logo tablets are significantly different. Thus, it seems probable that these two logos come from different manufacturers. As wY logo and wy logo tablets are the most popular tablets found in this region, it could be that two separate logo-producing groups are in fact the main methamphetamine manufacturers, distributing methamphetamine tablets in this region: UWSA could be the main methamphetamine-producing group, followed by the Shan United Army or the former Khun Sa Army.

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