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Extraction of Over the Counter Medications
A Preliminary Study Report

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Federal clandestine Methamphetamine cases are unique in the fact the amounts of finished product and precursor are used in Sentencing Guidelines to determine punishment. The weight of precursor has been used as the basis for "theoretical yield" estimations or the amount of Methamphetamine a particular site could produce.

In my experience the use of precursor in theoretical yields is based upon the dosage of the Pseudoephedrine (PSE) in the tablets or blister packs found at the scene. For example, if 100 tablets containing 60 milligrams of Pseudoephedrine are found, a total of 6 grams of precursor is available for conversion to Meth. This number is then converted to the amount of pure Meth. These types of calculations are based upon the "theoretical maximum" amount of precursor available in the tablets.

It is well documented in scientific and clandestine literature the PSE must be extracted from the tablets prior to use in the synthesis process. It is very difficult for any extraction process to yield 100% of the starting material. When you consider the unsophisticated equipment, supplies commonly found at these scenes and the lack of chemistry knowledge by the cook these extraction ratios would be much less than that of a trained chemist. There appears to be a void in the literature concerning the extraction percentages.

Over the counter meds contain other ingredients in addition to the Pseudoephedrine. The tablets may contain other "active" ingredients such as Acetaminophen, Triprolidene and Guafenesin. The tablets also contain "inactive ingredients" or "inert ingredients." These vary from tablet to tablet and their purpose may be as tablet coating, tablet coloring, emulsifiers and suspending agents. Some of these inactive ingredients were placed in the medication to thwart extraction of the Pseudoephedrine.

The following chart is presented to show the percentage of Pseudoephedrine to the total weight of the tablets analyzed in this study.

Tablet	Weight of Tablet	PSE Dosage	Weight Percent
Sudafed 24 Hour #1	0.3641 grams	0.240 grams	65.9%
Sudafed 24 Hour #2	0.3708 grams	0.240 grams	64.7%
Sudafed 24 Hour #3	0.3748 grams	0.240 grams	64.0%
Sudafed 24 Hour #4	0.3662 grams	0.240 grams	65.5%
Best Choice #1	0.1646 grams	0.030 grams	18.2%
Best Choice #2	0.1594 grams	0.030 grams	18.8%
Best Choice #3	0.1643 grams	0.030 grams	18.3%
Best Choice #4	0.1618 grams	0.030 grams	18.5%
Suphedrine #1	0.7007 grams	0.030 grams	4.3%
Suphedrine #2	0.7011 grams	0.030 grams	4.3%
Suphedrine #3	0.7162 grams	0.030 grams	4.2%
Suphedrine #4	0.7042 grams	0.030 grams	4.3%

On the basis of the amount of PSE present in relation to the total weight, one could surmise the Sudafed tablets would offer a greater ratio of recovery. Before we move on to the study, let's discuss the extraction processes found at clandestine labs.

Older extraction procedures found in many clandestine literature sources used an acid/basic extraction.[1] In this procedure water was used as a solvent. The solution was made acidic and filtered. The filtrate was then made basic and extracted with such solvents as Acetone or Coleman Fuel Oil. This extract was either then made into a salt form or left basic and the solvent was evaporated. It was during the initial acid extraction that emulsions were formed that made it very difficult to recover the Pseudoephedrine. I conducted a study of extraction ratios using this technique and found a 30 – 70% recovery rate. This result was within the range of the one clandestine literature cite I found where 63 – 65% was noted.[2]

The most common extraction procedure used in current cases involves the use of methanol or "Heet" as the solvent. Pseudoephedrine is soluble in methanol. The tablets are ground, soaked in solvent, filtered and then the methanol is driven off via various heat sources leaving Pseudoephedrine.

The method using "Heet" is a direct extract and the problem with emulsions is eliminated. Research into the various inert materials found that some of them are also soluble or will dissolve in the methanol found in "Heet". That indicates this extraction process is not specific for the Pseudoephedrine and these inert materials can add to the total weight of the extract. Those inert materials soluble in methanol are:

Hydroxypropyl Methylcellulose
Polyethylene Glycol
Polysorbate 80
Stearic Acid (slightly)
Povidone

It is unknown to this author if any of the above compounds have any effect on the conversion of Pseudoephedrine to Methamphetamine.

A study was conducted with the methanolic technique to determine the extraction ratios of Pseudoephedrine from OTC meds. Three different brand nasal decongestants found in previous casework were purchased. They are as follows:

1. Sudafed 24 Hour Non Drowsy Extended Release tablets containing 240 mg of Pseudoephedrine.
2. HyVee "Suphedrine Sinus" tablets containing 30 mg of Pseudoephedrine & 500 mg of Acetaminophen.
3. Best Choice "Maximum Strength" tablets containing 30 mg Pseudoephedrine.

These were divided in two groups for analysis. Group A consisted of the Sudafed which was subject to differing soaking times and conditions. Group B included the Hyvee and the Best Choice tablets which were extracted for the same amount of time and under same conditions.

The extraction procedure for Group A consisted of crushing 1 (one) tablet and placing the powder in 50 ml of "Heet" in a pint mason jar. The jar was capped to prevent evaporation. During the soaking period the jars were agitated to mix the solution.

A total of 4 Sudafed tablets were extracted.

Sample 1 One tablet was allowed to soak for one hour at room temperature.
Sample 2 One tablet was allowed to soak for two hours at room temperature.
Sample 3 One tablet was allowed to soak for three hours in a freezer.
Sample 4 One tablet was allowed to soak for four hours in a freezer.

At the end of the soak time the extract was filtered via a plastic funnel and conical shaped coffee filters into a torn aluminum tin. After all the "Heet" passed though the filter, the extract was placed upon a low heat source that consisted of a coffee warmer and the methanol was allowed to evaporate. After evaporation the aluminum tin was re-weighed and amount of powder determined.

Four tablets of each brand of Group B were ground and placed in pint mason jars. To the powder 50 ml of "Heet" was added. The jars were capped and allowed to soak at room temperature for a period of two hours. After the soak time was completed, the same filtration and evaporation process was used with these samples as was used in Group A.

The samples were then analyzed via GC/MS and a primary standard of Pseudoephedrine was used in the analysis. Quantitative analysis was conducted utilizing generally accepted procedures.

The following table highlights the analytical finds

Group	Sample	Weight PSE In Tablet	Weight Tablet	Weight Extract	Quant Solution	Extraction Ratio
A	1 hour R.T.	240mg	0.3641 g	.2057 g	10.6 mg/ml	89.8%
A	2 hour R.T.	240 mg	0.3708 g	.2807 g	12.8 mg/ml	57.19%
A	3 hour Freezer	240 mg	0.3748 g	.2922 g	10.5 mg/ml	57.09%
A	4 hour Freezer	240 mg	0.3662 g	.2983 g	14.0 mg/ml	66.35%
B	HyVee	30 mg	2.8715 g	1.7653 g	13.4 mg/ml	0%
B	Best Choice	30 mg	0.6643 g	0.5011 g	10.0 mg/ml	78.13%
					Average	69.71%

The data on the sample soaked for one hour suggests a higher ratio can be obtained. Since this is the only sample soaked for that period of time, further study should be conducted to determine if time is a critical element in the extraction of the precursor.

The data shows little difference in extraction ratios between room temperature and freezer samples in the 2 & 3 hour range. There was an average 13% increase by placing the sample in the freezer for 4 hours, but still not the same as what was obtained in one hour.

The interesting result was the HyVee Suphedrine. This contained 500 mg of Acetaminophen and 30 mg of Pseudoephedrine. Acetaminophen is also soluble in methanol. After the extract was filtered a clear viscous liquid was formed as the methanol evaporated. This is in contrast to the usual crystalline powder previously observed on the other samples. This liquid slowly turned off-white then to tan before forming a tan solid substance. Another tablet was subjected to the same procedure and this again formed a viscous liquid before evaporating into an off-white substance.

Further research will be conducted to examine the presence of other active ingredients and their effect on the extraction ratio of PSE.

The research does not indicate an appreciable greater quantity of Pseudoephedrine can be extracted by placing samples in the freezer as indicated in some clandestine literature.

The results of this preliminary study reveals have a direct bearing on federal clandestine Methamphetamine lab cases and the determination of theoretical yield.

Earlier in this document an example was presented using 100 tablets containing 60 mg of Pseudoephedrine. We will use that same example to demonstrate how the results of this study can affect the calculations. As previously mentioned, most calculations used in theoretic yields do not take into account the lost of the precursor during the extraction process. The amount of PSE is then multiplied by the conversion factor of 0.92 to obtain the amount of Methamphetamine at 100% conversion. It is after this number is derived that the real fighting begins!

This study indicates the amount of precursor available for conversion to Methamphetamine is not the total amount present in the tablets, rather averages 70.0% (actual 69.7%) of the weight of the drug. The following is presented to clarify this concept.

Pre Study

100 tablets X 60 mg/tablet (dosage amount) = 6.0 grams Pseudoephedrine (theoretical maximum)
6.0 grams Pseudoephedrine X 0.92 (conversion factor) = **5.4 grams of Methamphetamine**
This is at 100% conversion.

With the results of this preliminary study, the following calculations are presented.

Post Study

100 tablets X 60 mg/tablet (dosage amount) = 6.0 grams Pseudoephedrine (theoretical maximum)
6.0 mg Pseudoephedrine X 70% (average extraction ratio) = 4.2 grams PSE available for synthesis.
4.2 grams Pseudoephedrine X 0.92 (conversion factor) = **3.86 grams of Methamphetamine**.
This is at 100% conversion.

If consideration is now given to the conversion rate of the synthesis method a complete theoretical yield can be derived. For the sake of this discussion a 50% conversion rate is presented.

Pre Study: 2.7 grams Meth can be produced from the original 100 tablets of Pseudoephedrine.
Post Study: 1.93 grams Meth can be produced from the original 100 tablets of Pseudoephedrine.

I do not know the effect this study would have in those situations where the defendant is sentenced under 2D1.11,[3] the precursor quantity table. This table is derived at a 50% yield relative to Methamphetamine and provides some basis for the synthesis conversion rate.

As I am not an attorney I do not know if one can argue to the court the weight of Pseudoephedrine found in tablet form or through empty blister packs would not reflect the actual amount that would be available for synthesis, therefore the table does not accurately reflect the scale of the offense.

Summary

Previous case law on the subject of theoretical yields has indicated the drug quantities should be what the particular defendant could reasonable produce. For a long time the extraction of precursor factor has not been addressed and no literature sources on the subject were found.

This preliminary study addresses the first of the two sources of error in the clandestine manufacture of Meth, that being the loss of precursor during the required extraction process. This study, albeit preliminary, does shed some light on the amount of precursor that can be extracted from the over the counter medication. It appears a 70% ratio would provide a reasonable estimate on the amount of precursor that can be extracted from over the counter medication.

Further studies will be conducted on this topic dealing with a wider variety of over the counter meds, greater sampling and a more thorough examination of extraction times.

Sources Cited

1 Uncle Fester, *Secrets of Methamphetamine Manufacture*, Loompanices Unlimited, Port Townsend, WA, 1999
2 Videoeditor, *Universal Extraction Technique, Straight to Bee*, www.rhodium.cs
3 U.S. Sentencing Commission, 2002 Federal Sentencing Guideline Manual