

Documentation of a heroin manufacturing process in Afghanistan

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ABSTRACT

The present article documents an authentic process of heroin manufacturing in Afghanistan: white heroin hydrochloride produced using simple equipment and a small quantity of chemicals. The quantities of chemicals actually used corresponded to the minimum needed for manufacturing heroin. The only organic solvent used was acetone, and only a very small quantity of it was used.

Because the chemicals used in the demonstration were from actual seizures in Afghanistan, some of the chemicals had been disguised or repackaged by smugglers. Others had been put into labelled containers that proved to be counterfeit, and some glass containers used were not the original containers of the manufacturer displayed on the label.

The brown heroin base prepared as an intermediate step in the process shares some of the characteristics of the South-West Asia type of heroin preparations often seized in Germany. The final product of the documented heroin manufacturing process was white heroin hydrochloride, which shares the key characteristics of the white heroin occasionally seized in Germany and other countries in Western Europe since 2000. The present article demonstrates that this kind of heroin can be produced in Afghanistan.

Introduction

The United Nations Office on Drugs and Crime (UNODC) has estimated that Afghanistan is home to the world's largest area of opium poppy cultivation, supplying opium, the basic material used for the illicit manufacturing of heroin. Up to 90 per cent of the heroin seized in Western Europe is considered to be of Afghan origin. While, until 1999, most of the cases of opium smuggling were recorded in States bordering Afghanistan, in recent years there have been more and more indications that illicit heroin manufacturing is increasing in Afghanistan itself. In addition, in Western Europe, there has been a growing

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number of seizures of heroin of particularly high quality, referred to as "white heroin", whose origin is believed to be Afghanistan.

There are few descriptions of the methods used in illicit heroin manufacturing in publicly available literature. And almost all share a common flaw: they are based on either purely theoretical calculations or mere "evidence by inspection", in the form of an observer's description of the synthesis of heroin. Much of the information available lacks authenticity; so, estimates of the quantity of heroin manufactured, based on the total area known to be under opium poppy cultivation and the potential opium yield of that area, have, until now, relied on data that have not been scientifically substantiated. Analyses of illicit heroin manufacturing processes, including forensic sampling and sample examination, are rarely found in available literature.

Against that backdrop, the offer extended to German authorities by the central office of the Counter-Narcotics Police of Afghanistan (CNPA) in Kabul to observe an authentic heroin manufacturing process in Afghanistan presented a unique opportunity. In addition to gathering information and documenting the process, the task would be to collect for analysis authentic samples of the basic material (opium), the chemicals used and the heroin itself. The information obtained would be used in the German heroin analysis programme.

The Federal Criminal Police Office (BKA) of Germany seconded to Afghanistan two forensic chemists and a police officer responsible for criminal investigations in order to carry out the task. The method used to process the heroin was demonstrated by two male Afghan nationals from Nangarhar province, who described themselves as illiterate farmers. The laboratory equipment (chemicals, devices and aids) and the opium needed had been obtained in the course of seizures, and were provided by CNPA in Kabul. Samples of the substances and the chemicals used were taken at all stages of the manufacturing process.

Origin and selection of the opium

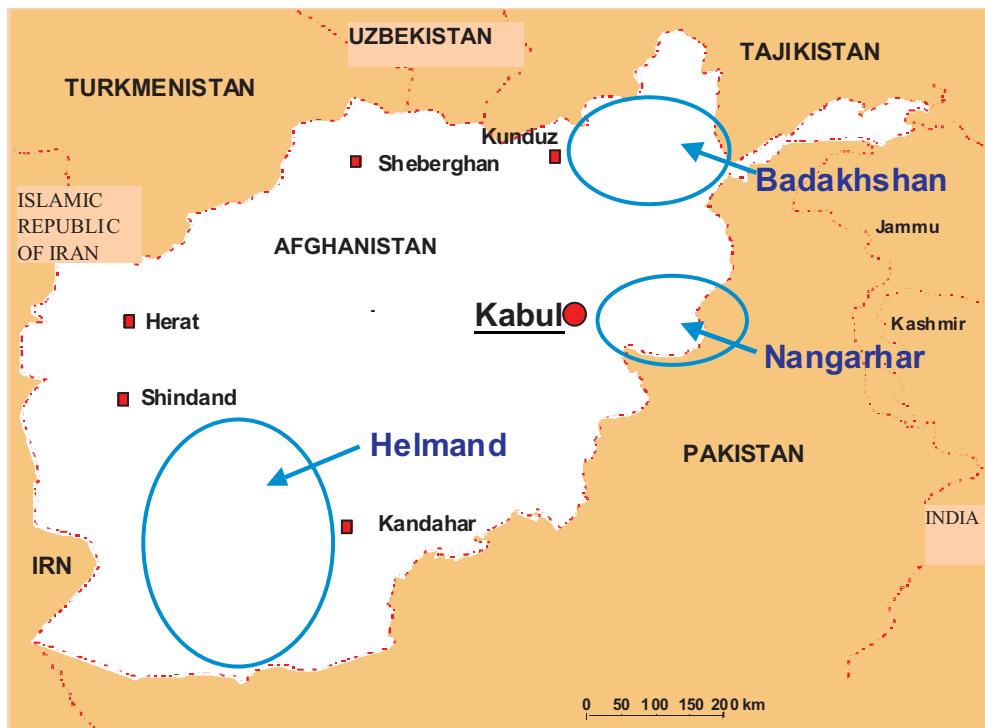
In Afghanistan, opium poppy is cultivated mainly in Badakhshan, Nangarhar and Helmand provinces (see the map). The raw opium used as the basic material to manufacture heroin is the air-dried milky latex from lanced opium poppy capsules.

Selection of the raw opium

At the CNPA facilities, the persons involved in processing the heroin assessed several batches of seized raw opium on the basis of appearance, odour and consistency. They selected opium of varying quality, with a total weight of 70 kilograms, as the base material for the heroin production.

According to CNPA, the raw opium was seized in Nangarhar, but because opium dealers frequently transport their goods from one province to another for processing, it could not be ruled out that all or part of the selected raw opium originated in another province.

Principle areas of opium poppy cultivation in Afghanistan: Badakhshan, Nangarhar and Helmand provinces



Note: The boundaries shown do not imply official endorsement or acceptance by the United Nations.



Documentation of the heroin manufacturing process

The present article includes a description of all stages of the heroin manufacturing process, followed by a flow chart summarizing those steps and listing the intermediate products and the chemicals needed. Explanations given and the names of substances used were confirmed by means of forensic analysis and expert knowledge. Finally, the process is discussed with reference to published accounts of manufacturing methods.



Extracting the morphine from raw opium

The raw opium was unwrapped, crushed and divided into two portions. The wrapping material was not entirely removed. The crushed opium was poured into two barrels and hot water was added.



The composition was stirred until it became a homogeneous suspension. The pH value was 8. The remaining plastic wrapping floated to the surface of the liquid and was scooped out. Then calcium oxide (anhydrous lime) was added, together with more hot water. The suspension was stirred well from time to time, for a period that lasted about an hour. During that period, sometimes hot water and sometimes a solution of calcium oxide (anhydrous lime) and hot water were used to rinse off any opium still stuck to the wrapping material. The rinsing solution was poured into the barrels containing the main substance. The barrels were then filled with hot water and left to stand overnight. By the next morning, a brownish foam residue and an oily film had appeared on the surface of the morphine solution. The pH value was measured at between 10 and 12. In the course of the extraction process, other water-soluble substances were co-extracted with the morphine.

Separating the morphine solution from the water-insoluble opium components

A hose was used to siphon the clear, dark brown morphine solution into two tubs.



After that, the solution was divided into four empty barrels. The sediment was stirred up, ladled out of the barrels with buckets and filtered through sacks that had been soaked in water. The entire filtrate was then poured back into the four barrels containing the morphine solution.

Treatment of the water-insoluble opium constituents

The sacks containing the opium residue were placed in a pressing device, and the liquid was squeezed out of them.



The liquid pressed from the sacks was added to the barrels containing the morphine solution. Then the press cake was removed from the sacks, divided in two parts, put in two barrels and treated with hot water to dissolve out more morphine. After being filtered and pressed, the additional liquid extracted from the sacks was also added to the main morphine solution.

Precipitation, isolation and drying of the morphine

Then ammonium chloride was added to each barrel while stirring continuously. The morphine base precipitated. The barrels were covered and left to stand overnight.



The next morning, the morphine base was filtered using two filtering baskets lined with cloth that had been soaked in warm water. The solution had a pH value of 9. The main morphine base substance, which was in the sediment, was stirred using some of the remaining liquid, thus producing a suspension. The suspension was then filtered out, and the filtrate was discarded. The moist morphine base remained in the cloth-lined filtering baskets.



The morphine base was wrapped in the filtering cloths and stamped out. Finally, the morphine base was spread out on a cloth to dry. Then, the air-dried morphine base was weighed.

Conversion of morphine to heroin

The amount of acetic anhydride needed for heroin synthesis was weighed out. (For the quantities of the chemicals used, see the section entitled “Laboratory equipment and chemicals” below.)



Then the acetic anhydride was added to the morphine base, which had been placed in an aluminium pot. A small excess of the chemical was added.



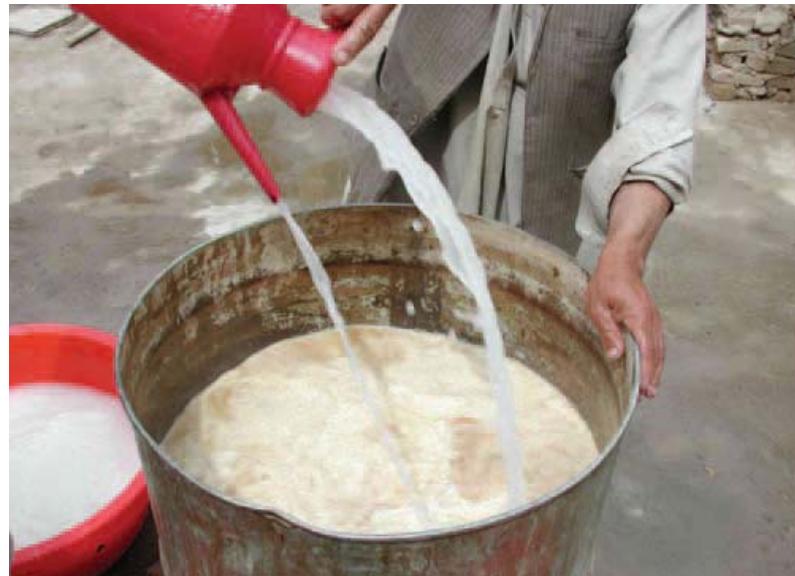
The pot was stirred until the morphine base had dissolved. The pot was covered, and the reaction solution was allowed to stand for 45 minutes. Then the pot was placed on a fire, and the reaction solution was heated for another 30 minutes.

After that, the reaction mixture was poured into a bowl that had been filled with hot water. Then the solution was filtered through a cloth, and the filtered solution was poured into an empty barrel.



Precipitation and isolation of the brown heroin base

Portions of sodium carbonate solution were poured into the barrel until gas was no longer released and the heroin base precipitated out.



The precipitated heroin base was immediately filtered out. The pH value of the solution was 10. The heroin base was then stirred up in hot water and filtered again. The washing process was repeated once more. Then the brown heroin base was poured into a bowl.



Purification of the brown heroin base

The brown heroin base was dissolved in diluted hydrochloric acid. The solution had a pH value of 7-8. Because not all of the heroin base had dissolved, the solution was filtered through a cloth. Activated carbon was then stirred into the

solution, and the liquid was allowed to stand for 30 minutes. Then the activated carbon was filtered out using a cloth. Because the solution was not yet clear, it was filtered a second time, using a paper filter.

Precipitation and isolation of the white heroin base

Then, the heroin base was precipitated using a diluted ammonia solution. The pH value was 12.



The white heroin base was filtered through a cloth.



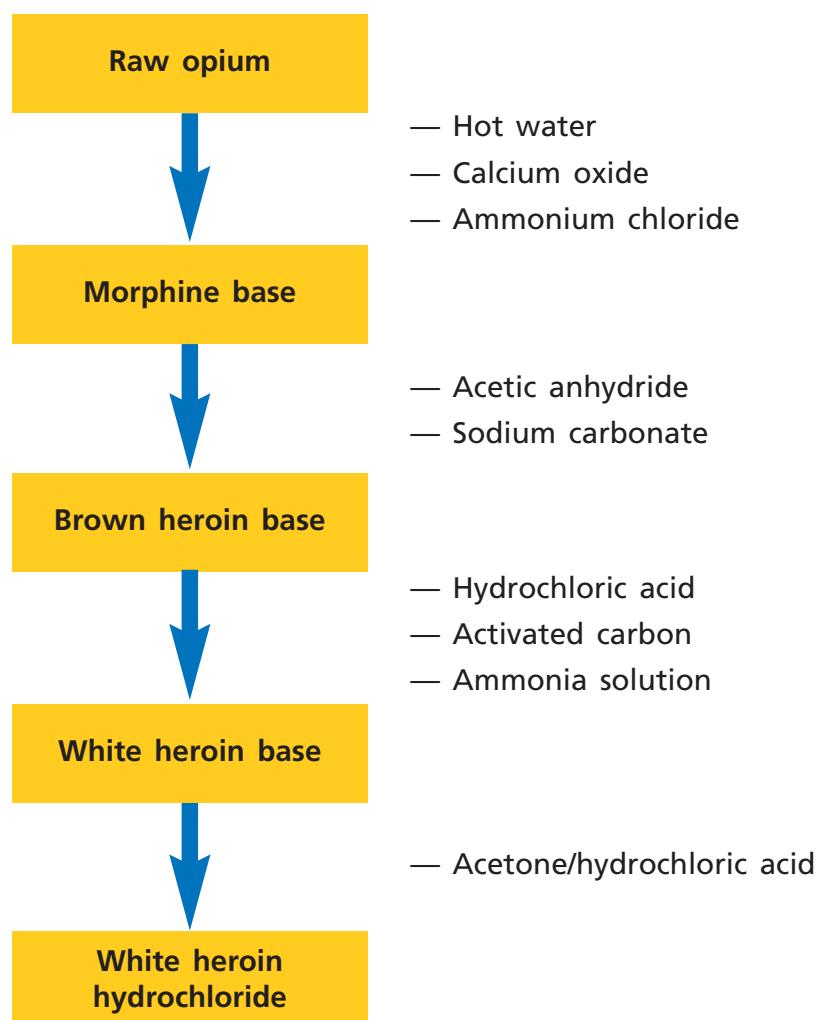
Conversion of the heroin base to heroin hydrochloride

The white heroin base was dissolved in a mixture containing hydrochloric acid and a small amount of acetone. The heroin solution was then filtered through a paper filter into a metal bowl and evaporated on a water bath. The white heroin hydrochloride precipitated.



A flow chart showing the basic steps in the heroin manufacture process is presented in figure I.

Figure I. Flow chart of the heroin manufacture process



Discussion

Currently, there are few publicly available descriptions of the processes used to make illicit heroin. The production processes, for which only very general descriptions are provided, use the Thiboumery and Mohr method, also known as the lime method ([1], p. 6) for the first step of extracting morphine from opium.

For example, Cooper [2] reported on the illicit production of heroin based on the extraction of morphine base using hot water and adding calcium oxide, followed by precipitation with ammonium chloride. The conversion to heroin base occurs by adding a large excess of acetic anhydride to the dried morphine base and heating it for 30 minutes. A further conversion to heroin hydrochloride is not described.

Recent publications of the United Nations Office on Drugs and Crime provide flow charts [3] and schematic presentations [4] of the illicit manufacturing of heroin preparations and refer to the main features of the Thiboumery and Mohr method as well as the use of organic solvents in an optional purification step for morphine isolation and the conversion of morphine into heroin hydrochloride. A report of the International Narcotics Control Board (INCB) presents a similar, but greatly simplified, flow chart for illicit manufacture of heroin hydrochloride [5].

The extraction of morphine base during the process observed by the authors was based, for the most part, on the Thiboumery and Mohr method. Unlike in the production process mentioned above, the morphine base was not purified with charcoal. That first purification step was carried out at the stage of the heroin base, that is, after the morphine had been converted to heroin. In this process, only a very small quantity of organic solvent was used, when the purified heroin base was transformed into heroin hydrochloride.

Laboratory equipment and chemicals

CNPA in Kabul provided the equipment (devices and aids) (see table 1) and chemicals (see table 2) used to manufacture the heroin.

The persons processing the heroin identified the chemicals by their external characteristics such as odour and appearance. Sparing use was made of all chemicals required for the production process, with the exception of water. Only a minute quantity of an organic solvent was used. Hot water was used as a solvent throughout the production process. Only a small quantity of the substance referred to as the "key chemical", acetic anhydride, was used. That amount was so small that it was at the bottom of the range of quantities of acetic anhydride reported to have been used in the process elsewhere. According to the persons processing the heroin, in this case, the fact that such a small quantity was used was not the consequence of a lack of availability of the chemical; they considered the amount sufficient for the traditional method that they used to make heroin.

Table 1. Equipment used to manufacture heroin

<i>Device or aid</i>	<i>Purpose</i>
Fireplace	To heat water
Firewood	To be used as heating material for the fireplace
Eight empty 200-litre barrels	To heat water, extract the morphine and precipitate the morphine base, etc.
Four plastic tubs	To collect pressed-out juice and filtrates, dissolve the heroin base etc.
Three or four tubs with punched holes	To be used as filtering baskets
Two or three laundry baskets	To hold the textile cloths used for filtering
Two small baskets	To hold the paper filters
Sacks and cloth	To filter solutions
Paper filters	To filter solutions
Press device	To press the water-insoluble opium residues
Large aluminium pot	To convert the morphine base into heroin
Watering can	To rinse the vessels and add the soda solution
Two cups with handles	To add ammonium chloride and activated carbon and mixing solutions
Two evaporators, consisting of: four portable stoves two stands two aluminium pots two metal bowls	To evaporate the heroin hydrochloride solution on a water bath
pH test paper	To test the pH value
Beam balance	To weigh raw opium, acetic anhydride, morphine base and heroin hydrochloride

Table 2. Chemicals used to make white heroin hydrochloride from 70 kilograms of raw opium

<i>Chemical</i>	<i>Estimated quantity</i>	<i>Estimated quantity per kilogram of opium</i>	<i>Estimated quantity per kilogram of heroin hydrochloride</i>
<i>kilograms</i>			
Calcium oxide (CaO)	7	0.1	1.8
Ammonium chloride (NH ₄ Cl)	20	0.29	5.1
Acetic anhydride (C ₄ H ₆ O ₃)	8	0.11	2.1
Sodium carbonate (Na ₂ CO ₃ x 10 H ₂ O)	20	0.29	5.1
Activated carbon	6	0.09	1.5
<i>litres</i>			
Water (H ₂ O)	2,000	28.6	512.8
Concentrated hydrochloric acid	1.5	0.02	0.38
Concentrated ammonia solution	1	0.02	0.26
Acetone (C ₃ H ₆ O)	0.15	0.002	0.04

According to CNPA, clandestine heroin laboratories are generally located in places inaccessible by motor vehicle. The chemicals and the equipment required must be carried by mule to the production site. For that reason, transport capacities can be very limited. Given those conditions, the minimum quantities of the chemicals required were used.

Some of the chemicals provided by CNPA for the demonstration came from actual seizures made by the authorities in Afghanistan. In some cases, the smugglers had repackaged the chemicals in an attempt to keep them from being discovered. For example, the sodium carbonate used in the demonstration was in a plastic bag originally intended for sugar. The acetic anhydride had been hidden in plastic canisters labelled "Hydrogen peroxide", which had been packed into 200-litre steel barrels, and the remaining space filled with petroleum jelly. Further, several chemical containers proved to be clearly counterfeit. The glass vessels used were not the original containers of the manufacturer displayed on the label. The trading unit labels, which at first sight appeared to be originals, on closer inspection turned out to be fake.

Analysis of the documented process

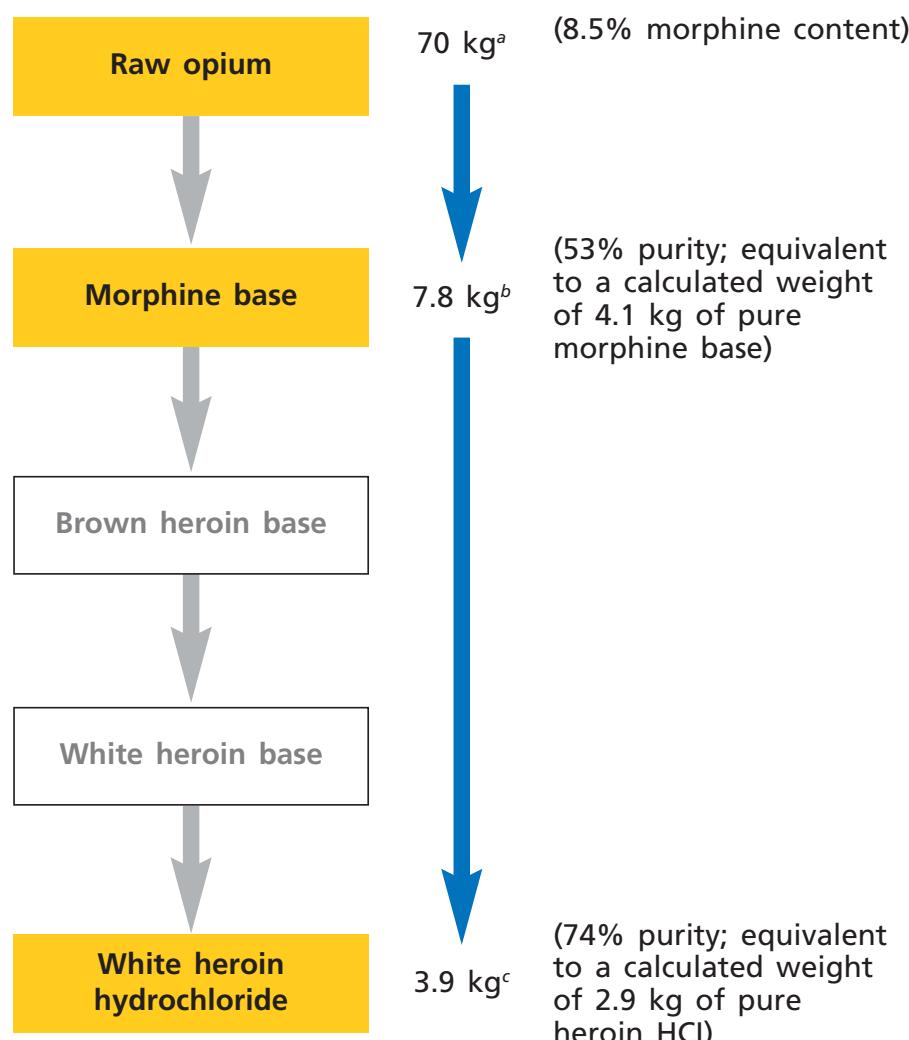
Yield

Some 7.8 kg of morphine base were obtained from 70 kg of raw opium, which is a yield of 11 per cent in terms of the weight of the raw opium. The yield of the final product, white heroin hydrochloride of 74 per cent purity, was 3.9 kg, that is, 6 per cent of the weight of the raw opium (see figure II). It was not possible to weigh the brown and the white heroin bases during the production process, because they were not dried but directly processed while wet.

In the literature, there are few instances in which the yield obtained at each step of the illicit heroin manufacture process is specified. According to UNODC [1], 10 kg of opium yields about 1 kg of morphine base—a yield of 10 per cent—which is considered to produce, in turn, about 1 kg of heroin base. The quantity of the morphine base produced using the method documented in this article is almost identical to that published quantity. However, the more recent UNODC data indicate a higher morphine content in raw opium from Afghanistan. Because of this and/or increased laboratory efficiency, a higher yield reportedly can be achieved, with a conversion ratio of between 7:1 and 6:1 [6]. For the above reasons, in the manufacture process documented, no measurement of the yield of heroin base could be made to compare with the data provided by UNODC.

The materials were weighed on location using a beam balance and weights that CNPA had borrowed from a local trader. Because the lightest weight was 500 grams, it was not possible to establish the exact weight of the materials. Thus, weights had to be estimated using expert knowledge. However, the quantity of acetic anhydride used could be precisely determined, because the weight of the acetic anhydride was established on the basis of the weight of the morphine base used. Due to its sticky consistency, the raw opium was weighed together with its wrapping material.

Figure II. Observed process for manufacture of heroin hydrochloride, stating the quantities of the raw opium, the intermediate morphine base and the final product



^aThe weight given for the opium used is that of the raw material at the place of manufacture.

^bThe weight given for the morphine base is that of the air-dried substance weighed on site.

^cThe weight of the white heroin hydrochloride is that of the substance dried on the water bath.

Analysis of active ingredients

The samples of the raw opium, the morphine base, the press cake, the brown heroin base, the white heroin base and the white heroin hydrochloride were transferred to polyethylene containers at the production site and stored at room temperature until they were analysed in Germany, at the Forensic Science Institute of BKA. Before the samples were analysed, they were dried over phosphorus pentoxide until their weight remained constant, except for the raw opium samples and the morphine base, which were analysed immediately.

The raw opium, the morphine base and the press cake were analysed to determine their active ingredients (see table 3).

Table 3. Analysis of active ingredients of the raw opium, the morphine base and the press cake, in free base form
(Percentage by weight)

Sample	Morphine	Codeine	Papaverine	Narcotine
Raw opium ^a (minimum-maximum)	8.5 (6.1-11.1)	2.7 (1.8-3.6)	1.4 (0.6-2.2)	8.6 (6.8-9.8)
Morphine base	53.1	3.8	2.4	20.3
Press cake	0.2	<0.1	1.2	3.7

^aAverage content calculated from the four visually distinguishable quantities.

The raw opium used was made up of four visually distinguishable quantities. The persons preparing the heroin examined the raw opium and said that they were not satisfied with it because it was of poor quality. Dry weights were used, except for the alkaloid content of the raw opium, for which the undried weight was used. The additional drying of the raw opium at 110 °C to a constant weight led to no significant change in the alkaloid content.

The average opium alkaloid content in dried, raw opium [1] is: morphine, 11.4 per cent (range: 3.1-19.2 per cent); codeine, 3.5 per cent (range: 0.7-6.6 per cent); papaverine, 3.2 per cent (range: <0.1-9.0 per cent); and narcotine, 8.1 per cent (range: 1.4-15.8 per cent). A more recent report from UNODC states that the morphine content of raw opium from Afghanistan ranges from 8.4 to 23.5 per cent [6]. The average morphine content of the raw opium used in the process documented is somewhat lower than those published values; that confirms the assessment made by the persons demonstrating this method of processing heroin.

The very lower residual morphine content of the press cake (0.2 per cent) indicates that almost all the alkaloid content was extracted from the raw opium used.

The brown heroin base, the white heroin base and the white heroin hydrochloride were analysed to determine their alkaloid content (see table 4).

Table 4. Analysis of the alkaloid content of the brown heroin base, the white heroin base and the white heroin hydrochloride, in free-base form
(Percentage by weight)

Sample	Diacetyl-morphine	Monoacetyl-morphine	Morphine	Acetylcodeine	Papaverine	Narcotine
Brown heroin base	68.1	7.8	1.8	5.0	1.1	6.0
White heroin base	78.5	6.8	2.0	4.7	—	—
White heroin hydrochloride	74.0	5.4	0.3	4.4	—	—

A relatively high monoacetylmorphine content (5.4-7.8 per cent) was found in the samples of the brown heroin base, the white heroin base and the white heroin hydrochloride. That could be a result of hydrolysis: because of the cool, rainy weather at the time of synthesis, it was not possible to completely dry the samples. According to the persons who demonstrated this method of heroin processing, intermediate products are usually directly processed or, as in the case of the morphine base, laid out and air-dried.

Heroin analysis programme

Within the framework of the German heroin analysis programme, seized heroin preparations are analysed to identify the quality of the material, the area of origin and links between individual cases. To that end, the *Länder* (federal states) submit an analysis report on the main components of seized heroin and/or an actual sample if the quantity seized is more than 100 grams.

The heroin analysis programme evaluates analyses of the main alkaloids of seized samples and, if the actual samples are available, also analyses trace components by comparing chromatographic patterns. The results obtained by that process are stored in a database. Thus, the database of the heroin analysis programme contains both data taken from reports on analysis results and data obtained from the direct analysis of samples.

The heroin analysis programme distinguishes three main types of heroin, according to area of origin: South-West Asian heroin, found in samples from Afghanistan and other countries in that subregion; South-East Asian heroin, found in samples from the Golden Triangle (the Lao People's Democratic Republic, Myanmar and Thailand) and other countries in that subregion; and South American heroin. At present, 7,100 sets of data, based on 4,050 data sheets and 3,050 actual samples, are stored in the database of the heroin analysis programme, which began in 1981.

Comparison with heroin analysis programme data

The results of the chemical analysis of the composition of main and trace substances contained in the samples taken from the documented manufacture process are compared with data from the heroin analysis programme and discussed below.

Morphine base

The morphine base of the process observed in Kabul had a purity of 53.1 per cent (see table 3). Morphine base has been seized in only a few cases in Germany. A total of 10 sets of data on samples of this type were stored in the database of the heroin analysis programme. Those samples had an average purity of 59.0 per cent, with a range of 38.4-83.6 per cent. The sample from Kabul has a similar average purity. The same is true for the content of the opium alkaloids codeine and papaverine. The 10 database samples had an average codeine

content of 5.0 per cent (range: 2.3-6.8 per cent) and an average papaverine content of 2.2 per cent (range: 0.6-3.8 per cent). The narcotine content of the 10 database samples varied widely, from 0.3 to 60.3 per cent. However, the average narcotine content, 21.4 per cent, was almost identical to that of the sample from Kabul.

Brown heroin base

The database of the heroin analysis programme contained 925 sets of data for undiluted and unadulterated brown heroin base from South-West Asia. There is no analytical information or intelligence on heroin of this type coming from South-East Asia.

The brown heroin base from Kabul has a diacetylmorphine content of 68.1 per cent (see table 4), which is higher than the average value of 53.7 per cent (range: 12.2-89.0 per cent) of the 925 database sets. In contrast, the narcotine content of the Kabul sample is relatively low: 6.0 per cent. The narcotine content of the database samples ranges from not detectable to 66.8 per cent. This shows that the narcotine must have been lost directly after acetylation (the reaction with acetic anhydride), either during the hydrolysis of the excess acetic anhydride (when adding the reaction solution to water) or during the precipitation of the heroin base. The brown heroin base from Kabul corresponds to the pattern of South-West Asian heroin, which predominates in the heroin preparations seized in Germany. A singular characteristic of the Kabul sample is its low narcotine content: 6.0 per cent (see table 4). The sets of data on samples attributed to South-West Asia have an average narcotine content of 21.8 per cent. Of the 925 sets of data from the database, only seven had similar ratios of total morphine (sum of the percentages of diacetylmorphine, monoacetylmorphine and morphine) to acetylcodeine, total morphine to papaverine, total morphine to narcotine and papaverine to narcotine, which made those samples suitable for comparison on the basis of the composition of the main ingredients. Five of the seven data sets came from data sheets; so, in those cases there were no actual samples available for additional examination (the comparison of the trace profiles). The trace profiles of the two remaining samples with a similar composition of main components, however, differed greatly from the trace profile of the brown heroin base from Kabul. Thus, it was not possible to find a comparable heroin preparation in the collection of BKA. The brown heroin base from Kabul is a variation of the South-West Asian type of heroin that had not been detected in Germany before.

White heroin base

The white heroin base has a clearly higher diacetylmorphine content than the brown heroin base: 78.5 per cent. In the process observed, the purification of the heroin preparation with the help of activated carbon was effective: an additional separation of papaverine and narcotine was achieved in the course of that processing stage.

The database of the heroin analysis programme does not contain data on white heroin base samples. It is not known whether such preparations have appeared yet in the drug scene in Germany. Probably, white heroin base is an intermediate product of white heroin hydrochloride manufacture that does not usually appear on the illicit market. The persons demonstrating how heroin was prepared confirmed that assumption when they said that they had never heard of anyone ordering that product.

White heroin hydrochloride

The conversion of the white heroin base to the final product of white heroin hydrochloride resulted in a slight decrease in the diacetylmorphine content, from 78.5 to 74.0 per cent. That could easily be explained by the additional dissolving and filtering process.

The heroin analysis programme collection contains 11 preparations of white heroin hydrochloride from 2002 and 2003 that have a similar diacetylmorphine content. None of those samples have a composition equivalent to the white hydrochloride from Kabul. The white heroin hydrochloride manufactured in the observed process is not identical to the type of heroin that is usually seized in Germany. As a rule, what is found in Germany is brown heroin base, which, in the manufacture process demonstrated, is no more than an intermediate product.

The so-called "white heroin" seized occasionally in Germany since 2000 is white or off-white heroin hydrochloride with a purity greater than 60 per cent calculated as base, believed to come from the South-West Asian region. Until now, it was unknown in which country that heroin preparation was produced. As the final product in Kabul shares key features of that "white heroin", it is clear that this kind of heroin can be produced in Afghanistan.

Additional findings

Upon questioning, the two Afghans who demonstrated the heroin manufacturing process provided valuable forensic information on the set-up and organization of a clandestine heroin laboratory in Afghanistan. They explained that they themselves did not own a clandestine heroin laboratory but had been hired by a person operating a laboratory and that that person also provided the equipment and the chemicals. They gave no information about the usual size of such laboratories or their production capacity. They said that the person ordering the heroin manufacture would provide the person running the laboratory with the base material, raw opium, in plastic bags in the form of "opium bread" weighing approximately 0.5-1 kilogram, which would be bundled and put into larger plastic bags weighing one "khaltar" (approximately 7 kg). Several "khaltar" would then be put in a sack for transport. The conclusion to be drawn from that is that the raw opium that is converted to heroin can consist of multiple batches of varying quality coming from different areas of production. The person ordering the narcotic drug also decides which product is to be manufactured and monitors the manufacture process. The preparation of the morphine

base and its subsequent conversion to heroin do not have to take place at the same laboratory. The manufacture itself takes place around the clock, without interruption, with a typical manufacture time of about 2-3 days. The process demonstrated by the two Afghans took about 50 hours.

It became clear from talking with the two Afghans and observing them that their work was the result of acquired skills communicated orally. They carried out all steps with great care and skill. It can be assumed, however, that they did not have any scientific training. They did not reveal whether they were able to use other methods of processing heroin.

Conclusion

An authentic process of heroin production in Afghanistan was documented. White heroin hydrochloride was manufactured using simple and widely available equipment and a small quantity of chemicals. The quantities of chemicals actually used corresponded to the minimum required for processing heroin. The only organic solvent used was acetone, and only a very small quantity of it was used. The brown heroin base prepared as an intermediate product during the manufacture process shares some characteristics with the South-West Asian-type of heroin preparations usually seized in Germany.

Previously, it had not been possible to confirm the hypothesis that heroin with a high purity level ("white heroin") seized in countries in Western Europe, including Germany, could be from Afghanistan, as suggested by police investigations, because samples of heroin seized in Afghanistan had not been available for forensic analysis. The final product of the heroin manufacture process documented in this article was white heroin hydrochloride, which, forensic analysis has revealed, shares the key features of the "white heroin" occasionally seized in Germany since 2000. Thus, it has been proved that this type of heroin can be produced in Afghanistan. The question remains whether white heroin is manufactured in other countries as well.

The authors were unable to determine whether the documented manufacture process is typical of Afghanistan because it is the only authentic heroin manufacture process that BKA of Germany has so far documented. The way in which the two Afghans prepared the heroin suggested that it was a commonly used method. The question remains whether other methods of processing heroin exist and, if so, how many. Nevertheless, the information gained provides numerous clues about the amount of heroin that can be produced from opium and the quantities of chemicals required.

The documentation of the heroin manufacture process has provided useful insight into the operations of clandestine heroin laboratories. That information will be used for training forensic scientists and drug law enforcement officers.

The information obtained in the course of the demonstration with regard to the chemicals used (their origin, type, amount, utilization, disguise and counterfeiting) supports operational drug enforcement measures. For example, as stated above in this article, smuggled chemicals are deceptively labelled or put

in containers intended for other chemicals. It is hoped that making use of all this information in law enforcement operations will help reduce heroin manufacture in Afghanistan, although such a reduction clearly depends, first and foremost, on social conditions in Afghanistan itself.

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