Iboga Extraction Manual

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I would like to thank Dr. Anwar Jeewa, Abdul Gani and Ismail Tayob for taking care of me during this work in South Africa

Introduction

In 2002, a comprehensive procedure to extract and purify the alkaloids of *Tabernanthe iboga* was published, and it can be downloaded from http://www.puzzlepiece.org/ibogaine/literature/jenks2002.pdf. The document was intended for the lay audience, to allow people involved in providing treatment for addiction to process *iboga* bark in a low-tech facility without requiring significant training. Since its publication, it has become clear that there is a need for a stepwise, detailed procedure manual to explain how to actually set up and operate the facility to process *iboga*. This manual will attempt to describe the equipment, chemicals and other resources, and procedures needed for a facility that can process approximately three kilograms of *iboga* root each day.

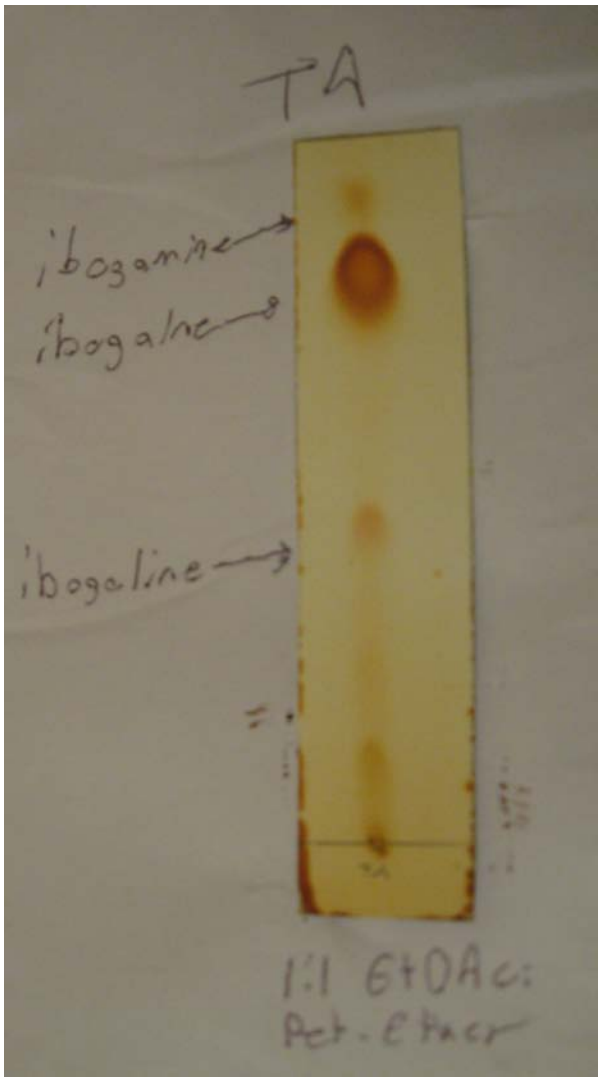
Determining the scale and goal of the laboratory

Questions to consider before taking any action include: How much ibogaine will need to be generated each day? Is this facility only meeting the needs of a single addiction treatment clinic, or will it provide product for other organizations as well? The size of the equipment in this manual, and the amounts of the chemicals, will have to be scaled based on the answer. Another early consideration should be what degree of purification of the *iboga* total alkaloid (TA) mixture will be considered adequate, since greater purification requires additional resources and labor and may reduce yields.

Choosing a location for the laboratory

Aside from choosing a country where isolation of ibogaine is not a crime, the laboratory should also not offend people nearby with vapors of ammonia or the common solvents used in the alkaloid purification. Care should be taken that the legitimacy of the laboratory is not questioned because of its use of low technology. Having the laboratory in close proximity to an *iboga* farm is especially convenient.

Selecting plant material



The TA content of *iboga* root can vary from zero to a few percent, and it can prevent heartache to test a batch of *iboga* root for its content of ibogaine before purchasing it. One way to do this would be to extract a weighed sample of root and process the extract to the TA stage, and then weigh the amount obtained. This will at least assure that the root contains some kind of alkaloid, and that there is a worthwhile amount of it. To confirm that the TA is primarily ibogaine, Thin Layer Chromatography (TLC) is a useful tool. To prepare a thin layer chromatogram, a pinch of root or bark powder or TA powder is stirred with about one milliliter of a solvent like ethyl acetate. A sample of the solution is applied using a thin (<1 mm) glass capillary to one end of a 2 cm by 8 cm piece of silica gel TLC sheet, and the sheet is placed in a sealed bottle with a little solvent, such as ethyl acetate, at the bottom, with the sample spot at the lower end. Once the solvent has climbed to the top of the sheet, the sheet is removed, dried, and the components on it made visible by exposing the sheet to iodine vapor or shortwave (254 nm) ultraviolet light if the sheet has fluorescent indicator. By this means the ibogaine can be distinguished from the other iboga alkaloids and its relative concentration estimated. Developing a TLC plate having more than one sample applied – one of unknown root, one of known ibogaine, and one of both samples combined – gives a strong confirmation of whether ibogaine is present in a sample. If the TLC plate is exposed to ammonia vapor it may cause the spots to appear much higher than otherwise, which may be the case for the TLC shown. If ethyl acetate brings the spots too high on the plate to separate them effectively, try adding some petroleum ether to the ethyl acetate in the development chamber. The ibogaline spot on the TLC shown may be distinguished by the pink color it turns as the iodine evaporates, but ibogaline is not present in all batches of *iboga* root..

If the choice between root or root bark becomes available, consider that root contains about one-third bark, and only the bark contains the alkaloids. Other than having about a third of the alkaloid content, the only disadvantage of buying whole root (at less

than 1/3rd the price) is that there is more bulk to handle in the extraction step. Otherwise, whole root is a good deal because the painstaking process of stripping off the bark is avoided. If you do not have ready access to a mill, then powdered root or bark are what you will want to obtain.

It seems logical that since *Tabernanthe iboga* is slow growing, is only found in a few African countries, and is the subject of drastically increasing demand, that its survival as a species will soon be endangered. It also seems unlikely that those who have been harvesting the plant, which necessitates killing it, have expended the extra effort to plant replacements. If you are concerned with the sustainability of including ibogaine as part of your addiction treatment arsenal, you can help ensure the survival of *T. iboga* by replanting, farming, or developing a culture of the root bark cells. In the future I hope that the worldwide need for ibogaine can be met by the more predominant *Voacanga* species in a sustainable fashion. Please contact me if you have information about Voacanga that might contribute to this effort.

Furnishing the laboratory

The laboratory described in this manual will require ventilation, electrical power and a supply of cold water. Shelves and tables are needed as in any laboratory, along with pegs for drying glassware, vertical metal bars for clamping equipment and (if desired) a press or centrifuge for separating water-based extract from root pulp. A station for drying alkaloid can consist of a commercial food dehydrator or makeshift equivalent.

Equipment needed

The equipment and chemicals required will depend on the degree of refinement that the *iboga* alkaloids will receive. The simplest equipment for the extraction step consists of plastic buckets, pillow cases, funnels, coffee filters and measuring equipment. The pillow cases should be standard size, made of white cotton. The buckets should hold at least 20 liters and, ideally, should provide a snug fit when lined with a pillow

case. The plastic funnels should have a diameter of at least 32 centimeters and preferably should rest stably on top of the buckets, and the coffee filters should overlap the funnels by several centimeters. A beginning lab should be able to utilize twenty buckets, ten funnels and four pillow cases. The measuring equipment needed will include scales and volumetric measuring containers. A scale with a capacity of at least two kilograms is needed to measure the root or bark powder, though the accuracy can be as poor as ten grams. A kitchen or postal scale is sufficient and economical. For measuring the TA and, later, purified total alkaloid hydrochloride (PTA HCl), a more sensitive scale, with accuracy around ten milligrams and a capacity of at least 300 grams, is important for accurate record keeping. If cost is a major concern, a sensitive, low capacity (50-100g) scale can be combined with a less sensitive, intermediate capacity scale. For measuring volumes of vinegar, water and ammonia, although measuring cups or beakers will do, the optimum equipment would be graduated cylinders. For the first step, capacities of 100 milliliters and one liter are convenient. Measuring large volumes of water is conveniently done with four liter Erlenmeyer flasks, which it is convenient to have four of for this step and the next. Once the alkaloid has been filtered, drying is a major operation. The ideal equipment for drying the alkaloid is a large (commercial) food dehydrator. Otherwise, an array of horizontal wire racks, with a heated fan blowing horizontally over them, should accomplish the same thing. For this step, white cotton hand towels, about a dozen, will be needed to absorb water from the wet TA. A sturdy coffee grinder and large (25 cm) sifter are needed for powdering the TA.

For the second step, the preparation of PTA HCl, about four smaller (20 cm wide) narrow-stemmed plastic funnels are needed. Fast filtering (grade 1) laboratory filter paper of the proper size (about 30 cm diameter) should be available for these funnels. A long-handled stainless steel spoon should be dedicated for stirring the TA during this extraction. The four liter flask used in this step should be equipped with a large (8 cm) magnetic stir bar, and a magnetic stirrer will be needed, along with a magnetic stir bar retriever. The magnetic stirrer should preferably have a hot plate built in, and it is useful to have a separate hot plate also. A calibrated plastic dropper is convenient at this step for adding hydrochloric acid, along with a 25 milliliter graduated cylinder. At this stage, access to a refrigerator will improve yields of PTA HCl. A freezer compartment will be helpful if continuing on with recrystallization. Part of this step includes removal of solvent, for which distillation (rather than evaporation) is strongly recommended. The equipment for distillation includes the aforementioned hot plate, along with a distillation apparatus which has (ideally) ground glass joints. An example of a parts list for such an apparatus would be two flat-bottom round flasks with standard taper ground glass joints, a distillation adapter, a West condenser, a vacuum adapter, and a thermometer which fits the distillation adapter. The flasks should each have a capacity of two liters each. Keck clamps should be used to secure the joints, while three-finger clamps secure the apparatus to the vertical bars mounted for this purpose. A twenty liter carboy should be reserved for storing the recycled solvent. After the distillation, a flat glass baking dish, about 30 cm by 50 cm, is needed to finish the solvent evaporation. About four one-liter Erlenmeyer flasks are useful for precipitation of the residual alkaloids (RA) recovered in this process.

For the recrystallization step, the only additional equipment needed are a set of

smaller flasks, depending on the desired scale. A set of four 250 milliliter Erlenmeyer flasks, along with matching (3 cm) magnetic stir bars will provide a good start.

Chemicals needed

For the extraction, the only chemicals needed are acetic acid and ammonia. Although other acids may substitute for the acetic acid in vinegar, white (distilled) vinegar has been sufficiently available that other acids have not been required, and the safety and complete evaporation of vinegar are advantages. Although glacial acetic acid could be diluted to give the same result, the only justification to do so is if it can be obtained more cheaply than vinegar. Similarly, regular 5% household ammonia can be used instead of concentrated ammonia as long as the dilution is accounted for, but concentrated ammonia tends to be less expensive if it is available. If household ammonia is used, it should be completely clear and not produce suds. Although other bases like sodium carbonate may substitute for ammonia, the ability to completely evaporate the ammonia is an advantage, though the fumes are a disadvantage. To process each kilogram of root, 1.5 liters of vinegar (at 5% acidity) or 75 milliliters of glacial acetic acid are required, along with 180 milliliters of concentrated (25-30%) or 1080 milliliters of household (5%) or 540 milliliters of janitorial (10%) ammonia.

In addition, for preparation of PTA HCl, concentrated hydrochloric acid will be required. The exact amount required is impossible to predict from the amount of root, but it will be approximately 5 to 15 milliliters per kilogram of root or bark. This step also requires about 500 to 1500 milliliters of acetone per kilogram of root or bark.

For recrystallization, 95% ethyl alcohol will also be needed.

Outline of ibogaine extraction and purification

The procedures proposed in this manual to extract *iboga* root and refine the TA and PTA HCl are based on the procedures published in 2002, but they will be discussed in more depth. The powdered root or root bark is extracted with diluted, room temperature vinegar or acetic acid, filtered through cotton cloth and the alkaloids (TA) are precipitated by adding ammonia solution. The precipitated TA is filtered through a coffee filter and dried in a stream of warm air. Once dried, the TA is powdered in a coffee grinder, sifted, and extracted with acetone. The filtered acetone is treated with concentrated hydrochloric acid to precipitate PTA HCl, which is filtered out. The acetone solution, still containing *iboga* alkaloids, is distilled to a small volume, evaporated in a stream of air, dissolved in water, filtered, and made basic with ammonia. The RA that precipitates is filtered and dried. Finally, if pure ibogaine is desired, the PTA HCl can be recrystallized from ethyl alcohol.

Extracting *iboga* root

The most labor intensive step is the extraction of the *iboga* root. Extracting the root basically means to stir it occasionally with diluted vinegar and filter through cloth. The step begins by measuring a planned amount of root or root bark powder and pouring it into a plastic bucket. If the extraction will be done manually then a scale of one or two kilograms is convenient, along with a bucket size of about 20 liters.

For each kilogram of root or root bark powder, five liters of 0.5% acetic acid solution should be used. This is conveniently made by diluting half a liter of common distilled vinegar containing 5% acetic acid with 4.5 liters of water. The extraction should be done at room temperature, since heating does not improve the ultimate yield and greatly impairs filtering. After the vinegar and water are added to the powder, the mixture is stirred enough to thoroughly wet the powder. For the next hour the mixture should be stirred every fifteen minutes. At the end of the hour, the mixture is poured into a bucket which has been lined with a pillow case, and the pillow case is lifted out and twisted and pressed to expel as much liquid as possible. This is best accomplished by one or two people, and trial and error have found the easiest method to be to press the twisted pillow case against the bottom of the bucket until excess fluid and gas have been expelled, and then (after retightening) to twist the bottom corners of the pillow case in opposite directions. Once all possible fluid has been expelled, the pulp is returned to the original bucket.

The most efficient way found to exhaust the alkaloids from the root is to use the extract from previously extracted root to extract new root. The way this looks in practice is that there is a row of buckets, carefully maintained in order of most-extracted root to freshest. After the bucket of fresh root (A) is extracted and the extract set aside, it is extracted again and the extract used to extract a bucket of fresh root (B). While bucket B is sitting, fresh diluted vinegar is added to bucket A. Once B is ready, this extract is set aside to precipitate alkaloids from, and bucket A is filtered and the extract put into bucket B. Bucket A is recharged with diluted vinegar, and after an hour a bucket C with fresh root gets the filtered extract from B, and B get the extract from A, which gets fresh diluted vinegar. This process repeats in the same pattern until the root in bucket A has been extracted nine times, by which time there is approximately 1/512th of the original alkaloid – little enough to justify discarding the root. Fresh vinegar now goes to bucket B, which gets discarded after its ninth extraction, so there should only be up to nine buckets needed for extracting root. Buckets should not be left for more than a few days without being extracted or bacterial contamination can set in. Once all the fresh root has been extracted, the series of buckets can continue to be processed until all the root has been extracted nine times.

Precipitating total alkaloid

After being pressed from the freshest bucket of root, each extract should be made basic with ammonia at the rate of 60 mL of 25-30% ammonia, or 360 mL of 5% ammonia, for each kilogram of root. This should correspond with 60 mL of 25-30% ammonia for each 500 mL of 5% strength vinegar used for extraction. After adding the ammonia the extract should be stirred. A gray to brown milkiness should appear. It doesn't hurt to add excess ammonia, but insufficient ammonia will allow some of the TA to stay in solution. When the amount of ammonia is adequate, the pH should be at least 9 and adding ammonia to the filtered solution should cause no precipitation. This mixture should be filtered through a coffee filter. It may be necessary to use a different filter for each kilogram of root to complete the filtration within a day or two, depending on the amount of alkaloid in the root. The filtration may be faster overall if the mixture is allowed to settle and the clearer liquid on top is passed through the coffee filter first. After all the liquid has been filtered and the funnel has drained, the funnel should be refilled once with water to rinse the alkaloid.

Drying and powdering the TA

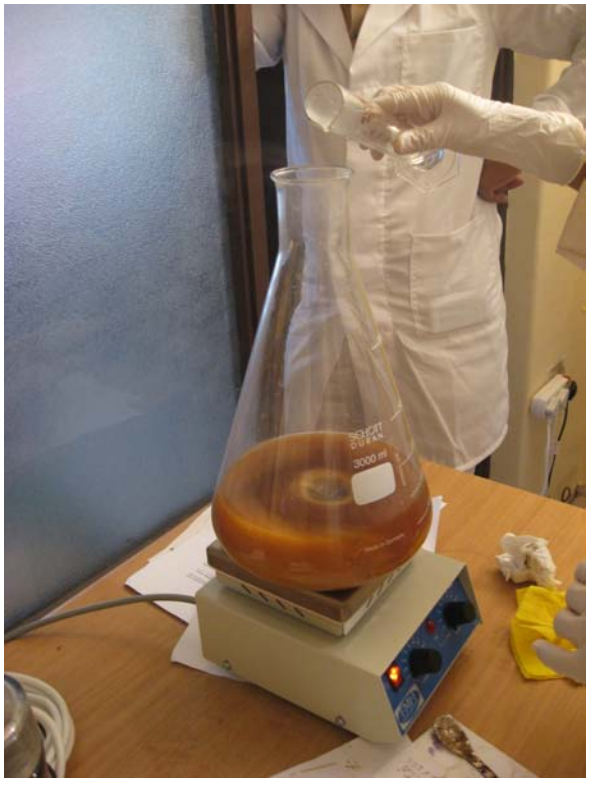
After the TA has been rinsed and drained, it should be carefully transferred onto a folded hand towel to drain and placed in front of a heated fan. It is unknown whether the TA will remain stable if dried above 50°C. The TA should be spread out with a knife to fill the available drying area at an even depth. As the solid dries it will become dark brown and will shrivel. After the

surface has darkened and pieces have crumbled, turn them over and break up large pieces to accelerate drying. Once the solid appears dry, grind it to a powder in a coffee grinder and sift it, and spread out the solid to dry further. The solid is dry when it loses little weight (e.g., less than three grams per kilogram of alkaloid per day) upon successive weighings. The papers used to filter the TA can be added to the bucket of the freshest root to recover the alkaloid on them.

An estimated composition of the TA is that is is about half biologically inert insolubles, maybe 35% ibogaine and 15% other similar alkaloids such as ibogaline and ibogamine, which from animal studies and anecdotal reports have effects similar to those of ibogaine. This TA powder may be suitable for addiction treatment. There has been debate about whether there are effects attributable to the TA that are not present in the PTA HCl or pure ibogaine. The advantage of using TA for treatment is that it contains practically all pf the ibogaine and similar alkaloids in the root, so very little is wasted.

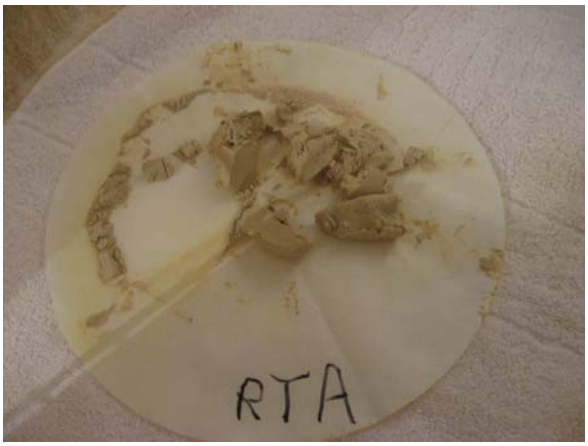
Preparing PTA HCl

To purify the TA, a portion is placed in a funnel (20 centimeter diameter) fitted with laboratory filter paper. The funnel is placed on an appropriate size Erlenmeyer flask (e.g., a four liter flask for a 100 gram batch) containing a magnetic stir bar. Acetone (15 milliliters per gram of TA) is added to the funnel in portions while the TA is stirred with it to leach out all the soluble alkaloid. Stirring needs to be done carefully to prevent rupturing the filter paper. As the acetone solution of alkaloid passes through the filter, fresh acetone is added to the funnel until all has been added. Once all the acetone has been added, stirring is started and hydrochloric acid (one milliliter for each six grams of TA) is added in small portions, slowly, until the precipitation of solid begins. After all the hydrochloric acid has been added, the flask is placed in the refrigerator overnight. The solid PTA HCl is then filtered through a 20 cm filter with a pre-weighed paper and the dark yellow solid is set out to dry. After removing the solid, both filter papers (from the TA and the PTA HCl) can be added to the bucket containing the freshest root to recover the alkaloids on them.



Recovering residual alkaloids (RA)

The acetone filtrate from the preparation of PTA HCl still contains a significant amount of ibogaine and similar alkaloids which can be recovered. To recover these alkaloids, the acetone should be mostly distilled and the rest evaporated, preferably outdoors. If distillation is unavailable it is possible to evaporate all of the acetone, given a good breeze and enough time. The process should be carried out in the absence of bright light and the residue should not be allowed to sit once it no longer smells of acetone. The dark, syrupy residue is dissolved in water (about 10 milliliters of water for each gram of TA used to make PTA HCl) and filtered through laboratory filter paper. The filtered solution is then made basic with ammonia (about one milliliter of 30% or six milliliters of 5% for each gram of TA used), mixed thoroughly, and filtered through laboratory filter paper. The light yellow solid dries into light chalky pieces which can be stored indefinitely. Although the RA has proportionally less ibogaine than even the soluble portion of TA, it is likely that a procedure will be found to separate the ibogaine and render it suitable for addiction treatment. To discard this ibogaine-rich material would be like discarding the silver recovered from a gold mine, aside from being a crime against nature! The filter papers can be put in the bucket with the freshest root to recover alkaloid it contains.



Further purification of ibogaine

Let me emphasize once again that the PTA HCl seems to provide treatment for addiction just as adequately as the same weight of pure ibogaine HCl. The other alkaloids present can be considered analogous to the theobromine which is present in coffee, along with its better known analog caffeine. Just as people usually don't worry about "contamination" from theobromine, and consider taking pure caffeine to be unnecessary to receive the benefit from coffee, excessive refinement of ibogaine will only contribute a percentage purity – but probably nothing else. On the other hand, although PTA HCl can be purified without loss of ibogaine using expensive chromatography, in the case of recrystallization the PTA HCl gets separated into fractions of greater and less pure ibogaine, all of which must then be dealt with.

The purification developed so far for ibogaine uses recrystallization of PTA HCl from 95-100% ethyl alcohol. The procedure can be simple. Place ten grams of PTA HCl into an Erlenmeyer flask, along with a magnetic stir bar if available, and add about 100 milliliters of ethanol. Heat the flask to simmering on an electric hot place, using the magnetic stirring if available or swirling by hand to keep the PTA HCl in motion. Once simmering, add ethyl alcohol in small portions, stirring or swirling and waiting about 30 seconds between additions, until all the solid dissolves. About 200 milliliters of ethyl alcohol should be required in total. If obviously foreign material is present, or solid which is clearly not dissolving any further despite addition of solvent, the hot solution can be filtered to keep the foreign solid from being present with the crystals. To minimize precipitation of solid during the filtration it is best to use a small funnel which is heated by simmering a small amount of ethyl alcohol in the receiving flask and allowing the vapor to heat the funnel. Although filter paper may be used in the filtration, precipitation may be reduced by stuffing a small wad of cotton into the neck of the funnel instead. The clear brown solution is then covered and left to cool as slowly as possible. A few tiny crystals of purified ibogaine HCl may be added if available to initiate the crystallization. Once the flask has sat at room temperature for a few hours it may be placed in the refrigerator, and several hours later moved to the freezer. The next day the liquid (mother liquor) is poured off the crystals, which should be stuck to the bottom of the flask. About half of the weight of the PTA HCl is lost in this first recrystallization. Repeating this procedure on the first crop of crystals will give about 3.6 grams of mostly pure ibogaine HCl from the 10 grams of PTA HCl. The mother liquor can be stored in the freezer and boiled down to half volume when convenient to receive further crystals when cooled, which may be added to PTA HCl for future

recrystallizations. The alkaloids left in the ethyl alcohol can and should be recovered using the procedure for recovering RA above.

Handling waste

The filter papers used in this work should all end up in the buckets of subsequent root being extracted, so that the alkaloid they contain can be recovered. After being extracted nine times, the root and filter papers can all be composted. The wastewater left after filtering the TA contains acetic acid and ammonia, and should make an excellent fertilizer when spread evenly over a lawn or garden. The acetone which is distilled in the production of PTA HCl contains traces of water and hydrochloric acid. It is suitable for washing and removing water from glassware. It may also give satisfactory results when reused for the production of PTA HCl, but whether the yield would be affected has not been studied. If the acetone can not be entirely used up for these purposes, it is relatively biodegradable and will have minimal impact if released into the environment. The same can be said for the ethyl alcohol used for recrystallization, but since this solvent should remain pure when distilled from the mother liquor, there is no reason not to reuse it for recrystallization. The TA which has been rinsed with acetone to produce PTA can also be composted.

Possible improvements

Although the yield is not improved by increasing the amount of acetic acid used to extract the root or the time spent extracting, it has not been determined whether the yield would be affected by using less than one hour for each extraction. The presence of water (from the concentrated hydrochloric acid) in the acetone used to prepare PTA HCl does not seem to reduce the yield of PTA HCl, but perhaps a less polar solvent like diethyl ether would increase the yield. In an experiment to recover alkaloids from the TA filtrate, the filtrate from 10 kg of root bark was extracted with petroleum ether. The petroleum ether was then extracted with vinegar and the vinegar was basified with ammonia, giving only 700 mg of precipitated alkaloid – not worth the effort at all.