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A Matrix-Reduced Whole-Plant Approach to Ayahuasca Preparation: Co-Extraction of Banisteriopsis caapi and Psychotria viridis

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Abstract

Ayahuasca is traditionally prepared by aqueous extraction and concentration of *Banisteriopsis caapi* and *Psychotria viridis*. The resulting beverage contains N,N-dimethyltryptamine (DMT), harmine, harmaline, tetrahydroharmine (THH), additional alkaloids, polyphenolic constituents, carbohydrates, organic acids, suspended solids, and numerous other plant-derived compounds. The source plants are chemically highly variable: DMT in dried *P. viridis* ranges from below detection to 17.75 mg/g, while *B. caapi* has contained 0.31–8.43 mg/g harmine, 0.03–0.83 mg/g harmaline, and 0.05–2.94 mg/g THH, with larger surveys extending these ranges to 18.27 mg/g harmine, 2.08 mg/g harmaline, and 29.04 mg/g THH. Finished ayahuasca contains the principal psychoactive alkaloids predominantly at milligram-per-milliliter concentrations, whereas individual non-alkaloidal constituents can occur at gram quantities within 50 mL, including fructose concentrations of 3.07–33.67 g/50 mL. Traditional decoction therefore produces a chemically broad preparation in which the pharmacologically central alkaloids constitute only a small fraction of the total extracted mass. This article proposes a matrix-reduced whole-plant preparation strategy based on joint extraction of the classical ayahuasca plants in a mildly acidified hydroethanolic phase. Experimental aqueous preparations establish simultaneous extraction of *B. caapi* and *P. viridis* into a common polar phase, while separate phytochemical extractions demonstrate that both source plants are compatible with the same 70:30 ethanol/water system containing 0.1% acetic acid. In separate extractions under these hydroethanolic conditions, dried P. viridis produced a concentrated crude-extract yield of approximately 8.2% of starting mass and dried B. caapi approximately 5.4%; these values serve as individual-matrix reference benchmarks rather than measured yields of the proposed simultaneous co-extraction. Botanical DMT extraction at pH 4 and experimentally determined pK_a values of 7.45 for harmine and 9.55 for harmaline support a common mildly acidic polar environment for the principal tryptamine and β-carboline constituents. The proposed process combines the two original botanical matrices before extraction, removes structural plant material after extraction, reduces the temporary ethanol fraction, and uses the resulting solvent transition to reduce additional soluble, colloidal, and suspended botanical matrix. Selective isolation of DMT or β-carbolines is not part of the process; the preparation remains a direct *B. caapi–P. viridis* whole-plant co-extract. DMT, harmine, harmaline, and THH provide the principal analytical markers for determining alkaloid retention, while total dry matter, suspended solids, carbohydrates, polyphenolic constituents, and broader metabolomic profiles quantify matrix reduction and preservation of phytochemical complexity. The practical target is substantial because nausea and vomiting occur frequently with conventional ayahuasca: vomiting occurred in 47% of participants in one clinical study, while nausea or vomiting occurred in 62.0% of 8,216 respondents

providing acute physical-effect data in the Global Ayahuasca Survey. By comparison, vomiting or retching occurred in 2 of 9 participants receiving a dried encapsulated botanical DMT/harmala formulation, and no vomiting or diarrhea occurred in a defined DMT/harmine formulation study. The matrix-reduced whole-plant approach therefore defines a distinct preparation technology between concentrated traditional decoction and molecular reconstruction: the classical botanical pair and its broad phytochemical architecture are retained as the direct source of the preparation, while excessive physical plant matrix becomes an independently controllable technological variable.

Keywords: ayahuasca, Banisteriopsis caapi, Psychotria viridis, N,N-dimethyltryptamine, DMT, harmine, harmaline, tetrahydroharmine, β-carbolines, hydroethanolic extraction, botanical matrix, whole-plant extraction, co-extraction.

1. Introduction

Ayahuasca comprises a heterogeneous group of Amazonian botanical preparations centered on Banisteriopsis caapi and commonly combined with a tryptamine-containing admixture plant, particularly Psychotria viridis [1,2]. The central pharmacological interaction derives from DMT in P. viridis and β-carboline alkaloids in B. caapi. Harmine and harmaline act as reversible inhibitors of monoamine oxidase A (MAO-A), reducing presystemic metabolism of orally administered DMT, while THH and additional β-carbolines contribute further pharmacological activity [3]. β-Carbolines derived from B. caapi possess pharmacological properties extending beyond the facilitation of oral DMT bioavailability, making ayahuasca a multicomponent botanical system rather than a simple DMT carrier [3,4].

The natural variability of this system is substantial. Callaway et al. analyzed 32 B. caapi samples and 36 P. viridis samples collected from 22 sites in Brazil. Harmine concentrations in dried B. caapi ranged from 0.31 to 8.43 mg/g, with a mean of approximately 4.83 mg/g; harmaline ranged from 0.03 to 0.83 mg/g, with a mean of approximately 0.46 mg/g; and THH ranged from 0.05 to 2.94 mg/g, with a mean of approximately 1.00 mg/g. DMT in P. viridis ranged from undetectable levels to 17.75 mg/g, with a mean near 7.5 mg/g [5]. All 32 B. caapi samples contained detectable harmine, harmaline, and THH, whereas some P. viridis samples contained little or no detectable DMT.

Santos et al. expanded this quantitative picture by analyzing 159 B. caapi samples and 33 ayahuasca preparations. Mean concentrations in B. caapi were approximately 4.79 mg/g harmine, 0.451 mg/g harmaline, and 2.18 mg/g THH. Concentrations extended to approximately 18.27 mg/g harmine, 2.08 mg/g harmaline, and 29.04 mg/g THH, with relative standard deviations of 78.9%, 92.4%, and 170%, respectively. Finished ayahuasca contained 0.109–7.11 mg/mL harmine, 0.012–0.945 mg/mL harmaline, 0.09–3.05 mg/mL THH, and 0.10–3.12 mg/mL DMT [6]. Kaasik et al. subsequently quantified DMT and the major β-carbolines in 102 traditional and analog ayahuasca samples and again found broad intersample variation [7].

Ayahuasca therefore has no single universal DMT-to-β-carboline ratio. Its chemical identity is better defined as a variable but recognizable whole-plant DMT–β-carboline system whose composition reflects botanical source, chemotype, plant age, growing conditions, harvest, relative plant proportions, preparation method, concentration, and storage. This variability makes preservation of the characteristic profile of the actual botanical batch more scientifically meaningful than standardization toward an arbitrary universal formula.

The chemistry of the two source plants also extends beyond the four principal quantitative markers. P. viridis contains additional indole-related and other plant constituents beyond DMT [8], while B. caapi contains a chemically broader β-carboline and polyphenolic spectrum. Wang et al. identified harmine, harmaline, THH, epicatechin, procyanidin B2, and additional constituents in standardized B. caapi extracts [9]. A direct whole-plant preparation is consequently chemically distinct from a reconstructed combination of DMT and one isolated MAO-A inhibitor.

Traditional ayahuasca production solves the extraction problem through prolonged contact between plant material and hot water. McIlhenny et al. directly analyzed DMT and harmala alkaloids in the Amazonian botanical medicine [10], and Gonçalves et al. prepared experimental decoctions containing the classical B. caapi–P. viridis combination and characterized their phytochemical profiles [11]. Joint processing of the two structurally different plant matrices therefore already constitutes the basic traditional extraction principle.

The same extraction mechanism also transfers and concentrates large quantities of non-alkaloidal plant material. Traditional ayahuasca combines botanical completeness with a large soluble, colloidal, and suspended matrix. Modern pharmaceutical formulations address this by isolating or enriching selected active compounds, thereby reducing physical plant burden but simultaneously reducing botanical complexity. A matrix-reduced whole-plant approach occupies the technological space between these two poles: the original plants remain the direct source of the medicine, while the amount of physical botanical matrix retained in the final preparation becomes an independent processing variable.

2. Quantitative Phytochemical Architecture

The four principal alkaloids provide a practical analytical framework for comparing plant materials and finished preparations. Their concentration ranges, however, also demonstrate why plant mass alone is an inadequate measure of pharmacological composition. Published quantitative analyses demonstrate substantial variability in the principal ayahuasca alkaloids across source plants and finished preparations (Table 1).

Table 1. Published concentration ranges of the principal ayahuasca alkaloids in source plants and finished preparations

Material	DMT	Harmine	Harmaline	THH	Reference
P. viridis, n = 36	0–17.75 mg/g	—	—	—	[5]
B. caapi, n = 32	—	0.31–8.43 mg/g	0.03–0.83 mg/g	0.05–2.94 mg/g	[5]
B. caapi, n = 159	—	up to 18.27 mg/g	up to 2.08 mg/g	up to 29.04 mg/g	[6]
Ayahuasca, n = 33	0.10–3.12 mg/mL	0.109–7.11 mg/mL	0.012–0.945 mg/mL	0.09–3.05 mg/mL	[6]
Traditional and analog ayahuasca, n = 102	0–approximately 2.68 mg/mL	broad range	broad range	broad range	[7]

These values mean that two preparations produced from identical nominal masses of vine and leaves can differ markedly in their final active-alkaloid composition. Quantitative comparison of preparation

technologies should therefore use the same botanical lots whenever possible and should measure DMT, harmine, harmaline, and THH in both the starting plants and final extracts.

The relative botanical proportions also vary across ayahuasca traditions and experimental preparations. A directly documented Barquinha preparation used 50% B. caapi and 50% P. viridis botanical material [12]. Another Barquinha preparation described in a non-human-primate study likewise contained a 50:50 botanical composition and, after prolonged aqueous processing, contained 0.36 ± 0.01 mg/mL DMT, 1.86 ± 0.11 mg/mL harmine, 0.24 ± 0.03 mg/mL harmaline, and 0.20 ± 0.05 mg/mL THH [13]. Other traditions use more B. caapi-dominant formulations, demonstrating that the botanical ratio itself forms part of the preparation tradition rather than a universal chemical constant.

For comparative work, the scientifically strongest design is therefore to preserve the established botanical proportion of the traditional reference preparation, express the experimental formulation on a dry-mass basis, and change only the extraction technology. A 50:50 botanical composition has direct precedent in chemically characterized Barquinha preparations [12,13], while *B. caapi*-dominant mixtures represent an equally relevant comparison where these are the established local formulation.

3. Co-Extraction and Hydroethanolic Extraction of the Classical Plant Pair

Co-extraction of B. caapi and P. viridis is an established feature of ayahuasca preparation. Gonçalves et al. experimentally prepared aqueous decoctions containing the classical plant pair and characterized their phytochemical composition [11]. Analyses of traditional ayahuasca likewise confirm the simultaneous presence of DMT and harmala alkaloids in the resulting botanical beverage [10].

Hydroethanolic extraction provides a second established extraction principle. Katchborian-Neto et al. extracted dried and crushed P. viridis leaves and B. caapi vine separately under identical solvent conditions, using ethanol/water 7:3 (v/v) containing 0.1% acetic acid at room temperature. The extraction medium was renewed every 24 h over three days. From 290.2 g dried P. viridis, 23.71 g concentrated crude extract was obtained, corresponding to approximately 8.17% of starting dry mass; from 298.3 g dried B. caapi, 15.96 g was obtained, corresponding to approximately 5.35% [14]. These results demonstrate that both source matrices are extractable under the same acidified hydroethanolic conditions. The present approach applies this common solvent environment to the two plants jointly.

These yields quantify the physical magnitude of material extractable from the two source plants under identical hydroethanolic-acidic conditions. The P. viridis leaf matrix produced approximately 1.5 times the crude-extract yield by percentage of starting dry mass compared with the woody B. caapi matrix.

Additional experimental studies have used extracts of B. caapi and P. viridis [15,16]. The solvent basis of the present proposal rests specifically on the separate hydroethanolic extractions of both source plants under identical conditions [14] and on established aqueous co-extraction [10,11].

Mild acidification is equally compatible with DMT extraction chemistry. Gaujac et al. optimized a DMT extraction and analytical procedure for Mimosa tenuiflora in which pH 4 was among the selected extraction conditions [17]. Analytical procedures for tryptamines and β-carbolines likewise employ acidic environments to maintain protonatable alkaloids in polar phases [18]. The principal ayahuasca β-carbolines and DMT are basic alkaloids, so a mildly acidic extraction environment favors their protonated forms and therefore their association with aqueous or hydroalcoholic media.

The resulting extraction logic is chemically direct. Water provides a strongly polar medium for ionic and highly polar constituents, ethanol broadens the solvent polarity range available to the botanical matrix, and mild acidification favors retention of protonatable alkaloids within the common polar phase. These

properties provide the chemical basis for simultaneous extraction of DMT, harmine, harmaline, THH, and a broader fraction of the original plant chemistry within the proposed co-extraction system.

4. The Botanical Matrix as a Quantitative Variable

The physical matrix of ayahuasca is quantitatively much larger than its principal psychoactive alkaloid fraction. Rodríguez et al. analyzed six ayahuasca preparations using nuclear magnetic resonance spectroscopy and liquid chromatography–tandem mass spectrometry and identified substantial concentrations of carbohydrates and other non-alkaloidal constituents [19]. Fructose ranged from 3.07 to 33.67 g per 50 mL among the six analyzed samples. The individual values were 33.67, 6.38, 9.29, 14.90, 3.07, and 8.10 g/50 mL. Glucose ranged from 0.37 to 5.27 g/50 mL, with values of 5.27, 1.46, 0.90, 1.67, 0.37, and 1.73 g/50 mL. Ethanol ranged from undetectable to 1.96 g/50 mL. Acetate, lactate, and additional soluble constituents were also identified [19].

The scale difference is considerable. A finished ayahuasca preparation containing 1 mg/mL DMT provides 50 mg DMT in 50 mL, whereas the same volume in the Rodríguez et al. dataset could contain several grams to more than 30 g of fructose alone. Even preparations at the upper end of the published DMT range remain quantitatively dominated by non-DMT plant material. The same applies to harmine, harmaline, and THH, which remain at milligram-per-milliliter concentrations while major matrix constituents occur at gram quantities [6,19].

The botanical matrix is not chemically inert. Rodríguez et al. detected harmine in suspended material, demonstrating that alkaloids can partition partly into particulate or colloidal fractions [19]. Matrix reduction therefore cannot be equated with maximal clarification or with indiscriminate removal of all suspended matter. The relevant technological objective is reduction of excessive physical mass while retaining the characteristic DMT–β-carboline profile and a broad spectrum of soluble botanical constituents.

This distinction is reinforced by the chemistry of the source plants. B. caapi contributes polyphenolic constituents including epicatechin and procyanidin B2 alongside harmine, harmaline, and THH [9], and P. viridis contributes a broader phytochemical fraction beyond DMT [8]. A whole-plant preparation remains chemically broader than a reconstructed formulation even after substantial reduction of structural plant matter.

The key variable is therefore the relationship between retained characteristic phytochemistry and total physical plant burden.

5. Gastrointestinal Burden of Traditional Ayahuasca

Nausea and vomiting are among the most frequent acute physical effects associated with ayahuasca. Riba et al. observed nausea and related somatic effects in healthy volunteers receiving standardized ayahuasca [20], while subsequent pharmacokinetic work characterized the oral absorption, metabolism, and disposition of DMT and the principal β-carbolines [21–25].

The magnitude becomes particularly clear in clinical and large observational datasets. Sanches et al. reported vomiting in approximately 47% of participants following ayahuasca administration in an open-label study of recurrent depression [26]. Palhano-Fontes et al. likewise recorded nausea and vomiting among prominent acute effects in a randomized placebo-controlled trial in treatment-resistant depression [27]. Durante et al. evaluated 614 religious users and found gastrointestinal effects among the common acute physical responses [28].

The Global Ayahuasca Survey included 10,836 respondents, of whom 8,216 provided data for analysis of acute physical effects. At least one acute physical effect was reported by 69.9% (5,742/8,216), while nausea or vomiting specifically occurred in 62.0% (5,097/8,216) [29]. Among participants reporting only a single lifetime ayahuasca exposure, nausea or vomiting occurred in 47.0% (281/598) [29].

Ayahuasca-associated gastrointestinal effects arise from several interacting mechanisms rather than from a single compound. DMT and β-carboline pharmacology, serotonergic signaling, gastrointestinal motility, individual susceptibility, concentrated bitterness, astringency, odor, viscosity, dissolved plant constituents, and suspended botanical material all contribute to the total exposure. The physical matrix is technologically important because it can be modified without replacing either of the original source plants.

More defined formulations provide a quantitative pharmacological comparison. Bonomo et al. administered dried encapsulated botanical DMT/harmala formulations and observed vomiting or retching in 2 of 9 participants [30]. Dornbierer et al. evaluated defined DMT/harmine formulations and observed no vomiting or diarrhea [31]. These preparations differ from classical *B. caapi–P. viridis* ayahuasca, but they demonstrate that the DMT–MAO-A interaction can occur with substantially less gastrointestinal burden than that associated with conventional concentrated botanical preparations.

The matrix-reduced whole-plant approach retains B. caapi and P. viridis as the botanical sources while modifying extraction technology and retained physical mass.

Purging also possesses cultural, medicinal, and ceremonial significance in several Amazonian traditions. Politi et al. analyzed the pharmacological and cultural importance of emesis and purging and described cleansing, therapeutic, symbolic, and ritual functions [32]. Matrix reduction therefore creates an additional preparation option rather than a universal replacement for concentrated traditional decoction.

6. Proposed Matrix-Reduced Whole-Plant Preparation

6.1 Botanical material and composition

Dried botanical material is mechanically reduced in size before solvent extraction, increasing solvent-accessible plant surface while retaining the complete starting matrices [14]. The two plant materials are combined before extraction and processed within a common polar phase, preserving the defining whole-plant co-extraction principle of classical ayahuasca [11].

The botanical ratio is expressed on a dry-mass basis because water content otherwise introduces substantial measurement error. A 50:50 botanical composition has direct precedent in Barquinha ayahuasca preparations [12,13]. In one analyzed 50:50 preparation, the finished beverage contained 0.36 ± 0.01 mg/mL DMT, 1.86 ± 0.11 mg/mL harmine, 0.24 ± 0.03 mg/mL harmaline, and 0.20 ± 0.05 mg/mL THH [13]. More B. caapi-dominant formulations occur in other preparation traditions, and the relevant ratio for comparative work is therefore the established ratio of the specific traditional preparation being reproduced.

Because botanical alkaloid concentrations vary by several-fold between plants and batches, comparative preparation should retain the same B. caapi and P. viridis lots and the same relative dry-mass proportion. This keeps botanical chemistry constant while extraction technology becomes the principal experimental variable.

6.2 Acidified hydroethanolic co-extraction

The combined botanical matrix is processed in a mildly acidified hydroethanolic environment. The same acidified hydroethanolic solvent system has previously been applied separately to each of the two source plants, using 70% ethanol and 30% water (v/v) containing 0.1% acetic acid [14]. In those extractions,

dried and crushed botanical material was processed at room temperature over three days, with renewal of the extraction solvent every 24 h [14]. The proposed preparation applies this solvent environment to the combined B. caapi–P. viridis matrix.

The separate extractions produced concentrated crude-extract yields of approximately 8.2% for P. viridis and 5.4% for B. caapi [14]. These values provide reference benchmarks for the individual matrices rather than predicted yields for simultaneous co-extraction; the total yield and alkaloid recovery of the combined B. caapi–P. viridis matrix must therefore be determined experimentally.

Mildly acidic conditions around pH 4 are compatible with DMT extraction from botanical material. Gaujac et al. used pH 4 among optimized conditions for DMT determination from Mimosa tenuiflora [17]. Harmine and harmaline have experimentally determined pK_a values of 7.45 ± 0.03 and 9.55 ± 0.04, respectively [33]. Under mildly acidic conditions around pH 4, both β-carbolines therefore occur predominantly in protonated forms compatible with aqueous and hydroalcoholic extraction media [18,33].

The resulting solvent system combines three chemically complementary properties. Water supports highly polar and ionic constituents, ethanol expands the solvent range toward less polar botanical metabolites, and weak acidification maintains basic alkaloids predominantly in protonated forms within the common polar fraction. The principal target profile therefore remains DMT, harmine, harmaline, THH, minor β-carbolines, and the broader soluble chemistry originating from both source plants.

6.3 Primary filtration

Following hydroethanolic extraction, the bulk leaf and woody vine structures are separated mechanically from the common liquid extract. The resulting liquid remains a direct co-extract of both plants rather than a mixture reconstructed from isolated alkaloids.

6.4 Ethanol reduction and solvent transition

Ethanol functions as the broad-polarity extraction component rather than as a defining component of the final oral preparation. Reduction of the ethanol fraction shifts the liquid progressively toward a predominantly aqueous environment. Ethanol has a normal boiling point of approximately 78.4 °C at atmospheric pressure, but preferential removal of the more volatile ethanol fraction does not require reaching this temperature. Because ethanol possesses substantial vapor pressure below its boiling point, ethanol reduction can be facilitated at lower temperatures by increasing the exposed liquid surface area and gas-phase exchange. The optimal mild thermal conditions required to maintain practical processing times while minimizing thermal degradation of plant metabolites remain an empirical variable to be established. During this solvent transition, the liquid progressively returns toward a predominantly aqueous phase. The resulting change in solvent polarity alters the solubility and colloidal behavior of co-extracted plant constituents.

The solvent transition is phytochemically relevant because compounds that remain soluble in a 70:30 hydroethanolic environment may become less soluble as ethanol concentration falls. Aggregation, precipitation, colloidal redistribution, and phase-associated changes can therefore generate an additional mechanically separable matrix fraction. The mildly acidic environment favors continued association of protonated DMT and β-carbolines with the polar liquid phase [17,18,33]. Protonation does not, however, preclude adsorption to precipitating plant material, colloidal association, physical entrapment, or co-precipitation within the complex botanical extract. The solvent transition may therefore redistribute a fraction of the target alkaloids into the mechanically separable matrix, making direct mass-balance analysis necessary.

6.5 Matrix redistribution and clarification

Secondary clarification reduces the fraction of botanical material that becomes insoluble, aggregated, or mechanically separable after the transition toward a predominantly aqueous phase. The objective is preservation of the broad phytochemical profile rather than maximal visual clarity.

This distinction follows directly from the finding that harmine can occur within suspended ayahuasca material [19]. Matrix reduction and alkaloid recovery are therefore coupled analytical variables. DMT, harmine, harmaline, and THH should be quantified in the extract before clarification, in the clarified liquid fraction, and in the separated matrix fraction. Alkaloid recovery and removed dry mass can then be quantified directly, while broader chromatographic or metabolomic profiling determines the distribution and retention of minor β-carbolines, polyphenolic constituents, and other plant metabolites. The analytical objective is therefore to quantify the relationship between removed dry mass and retention of the characteristic alkaloid and broader phytochemical profile.

6.6 Final whole-plant preparation

The final product is defined as a direct liquid co-extract of B. caapi and P. viridis in which preservation of DMT, harmine, harmaline, THH, minor β-carbolines, polyphenolic constituents, and broader soluble plant chemistry constitutes the principal analytical target. Retention of DMT, harmine, harmaline, and THH is quantified before and after matrix reduction, while chromatographic or metabolomic profiling determines preservation of the broader phytochemical spectrum.

The preparation technology combines established aqueous co-extraction of the classical botanical pair [11], hydroethanolic extraction conditions shown separately to be compatible with both source matrices [14], mildly acidic DMT- and β-carboline-compatible extraction chemistry [17,18,33], and physical reduction of the quantitatively dominant botanical matrix [19]. The defining analytical outcome is preservation of characteristic whole-plant chemistry relative to the reduction in total physical botanical burden.

7. Distinction from Pharmahuasca and Other Reformulations

Pharmahuasca demonstrates that oral DMT activity can be generated by combining DMT with a reversible MAO inhibitor. Ott's human pharmacology work with oral DMT plus harmine established this basic pharmacological principle [34]. The matrix-reduced whole-plant approach differs because DMT and β-carbolines are not introduced as isolated active principles; they remain embedded in a broad extract derived directly from the original plants.

The distinction is especially relevant to B. caapi. Harmine, harmaline, and THH occur naturally in variable proportions [5,6], and β-carbolines have pharmacological actions extending beyond MAO-A inhibition [4]. THH, minor β-carbolines, epicatechin, procyanidin B2, and other plant-derived constituents distinguish a direct B. caapi extract from a formulation containing isolated harmine alone [4,9].

The same applies to P. viridis. Isolated DMT represents the principal psychedelic alkaloid but not the total phytochemical fraction extracted from the leaf [8]. A direct co-extract therefore preserves a chemically broader preparation than a molecular reconstruction.

Changa represents another technological reformulation of the DMT–β-carboline principle and changes the administration route from oral ingestion to inhalation [35]. Smoked DMT bypasses gastrointestinal absorption and shows a distinct metabolic disposition from oral DMT administration [25]. Lyophilized ayahuasca changes the physical form while preserving the principal extracted alkaloid profile [36]. Matrix-

reduced co-extraction is distinct from both because it modifies the extraction and retained matrix before final administration.

8. Optional Dry Whole-Plant Presentation

Whole ayahuasca can be converted into a dry preparation without reducing it to isolated alkaloids. Riba et al. administered freeze-dried encapsulated ayahuasca to healthy volunteers and demonstrated the characteristic oral pharmacological and subjective effects of the preparation [20,23]. The use of capsules separates the pharmacological botanical extract from the concentrated taste, odor, viscosity, and astringency of the traditional liquid.

Daldegan-Bueno et al. developed and analytically evaluated an ayahuasca lyophilization procedure. Approximately 2 L of liquid ayahuasca produced 295 g of freeze-dried material, corresponding to approximately 14.75% dry matter, and the principal alkaloids were quantified before and after lyophilization [36].

The quantitative dry-matter yield is directly relevant to matrix reduction. A conventional liquid preparation can therefore contain approximately 147.5 g of total dry material per liter at the reported concentration, while the pharmacologically central alkaloids constitute only a small fraction of that mass. Reducing nonessential matrix before drying would correspondingly reduce the amount of solid material required in a final whole-plant dry presentation.

The dry form remains distinct from pharmahuasca because the material inside the capsule is dehydrated botanical extract rather than isolated DMT combined with selected purified MAO inhibitors. The botanical identity, extraction-derived β-carboline spectrum, and broader plant chemistry remain linked within the same material.

9. Practical and Traditional Applicability

Traditional ayahuasca preparation is technologically accessible because it depends primarily on botanical knowledge, vessels, water, heat, filtration, and locally available plant material. Thermal processing can nevertheless be extensive. A chemically characterized Barquinha preparation containing 50% B. caapi and 50% P. viridis was boiled in water at 100 °C for 60 h and subsequently contained 0.36 ± 0.01 mg/mL DMT, 1.86 ± 0.11 mg/mL harmine, 0.24 ± 0.03 mg/mL harmaline, and 0.20 ± 0.05 mg/mL THH [13]. This 60-h preparation illustrates the substantial processing time and sustained thermal exposure that can accompany conventional decoction [13].

Hydroethanolic maceration changes this resource profile by transferring much of the extraction process from prolonged thermal treatment to solvent-assisted extraction at room temperature. The same classical plants remain the starting material, and the final preparation remains a direct botanical extract. The technological requirements therefore remain substantially closer to ordinary botanical processing than to pharmaceutical alkaloid isolation.

Because the proposed process remains based on the original botanical materials and botanical extraction rather than isolated-alkaloid production, it can be evaluated within Indigenous, traditional, religious, and community-based preparation settings using community-specific plant ratios and the same botanical batches as the reference preparation. The relevant experimental comparison is between two extraction technologies applied to the same botanical material. The same B. caapi and P. viridis lots, the same dry-mass ratio, and the same intended final alkaloid exposure can be compared with respect to extraction yield,

total dry matter, DMT, harmine, harmaline, THH, suspended solids, sensory properties, energy use, preparation time, nausea, vomiting, and overall gastrointestinal burden.

This approach also respects the fact that purging does not carry the same meaning in all contexts. Where vomiting is intentionally incorporated into the therapeutic or ceremonial logic, concentrated decoction may remain the preferred form. Where reduced nausea, reduced vomiting, easier ingestion, lower botanical mass, or simpler processing is desired, matrix-reduced preparation offers an additional form based on the same plants.

10. Discussion

The quantitative literature identifies botanical matrix as a major independent variable in ayahuasca preparation. The principal psychoactive alkaloids occur mainly at milligram-per-milliliter concentrations [6,7], while major non-alkaloidal constituents can occur at gram quantities in a single 50-mL portion [19]. This scale difference establishes that a substantial part of the physical mass of ayahuasca is chemically distinct from the four principal psychoactive alkaloids.

The extraction literature further demonstrates that both source plants are compatible with the same 70:30 ethanol/water medium containing 0.1% acetic acid [14]. The same classical plants can also be co-extracted into a common aqueous phase [11]. Integration of these two established properties provides the chemical basis for a direct hydroethanolic whole-plant co-extraction strategy in which prolonged boiling is no longer the only extraction technology applicable to the paired botanical system.

Acidic extraction chemistry provides the third component. DMT extraction from botanical material has been optimized at pH 4 [17], while analytical extraction data and the experimentally determined pK_a values of harmine and harmaline support β-carboline compatibility with acidic polar media [18,33]. Mild acidification therefore provides a common polar extraction environment compatible with DMT and the principal β-carbolines without requiring independent alkaloid isolation.

Clinical and large observational datasets establish gastrointestinal burden as a frequent feature of conventional ayahuasca administration [26,29]. Gastrointestinal effects reflect interacting pharmacological, physiological, sensory, and botanical-matrix factors. Physical botanical load is therefore a directly modifiable preparation variable while the original botanical pair remains unchanged.

More defined DMT/harmine and botanical DMT/harmala formulations show that oral DMT–MAO-A pharmacology remains possible with substantially less physical botanical material [30,31]. Their relevance is therefore mechanistic rather than botanical: the central oral interaction does not depend on ingestion of the complete concentrated decoction matrix. The present method retains more of the botanical system than these comparators by maintaining B. caapi and P. viridis as direct source materials.

The same logic applies to sensory burden. Traditional concentrated ayahuasca combines pharmacologically active compounds with carbohydrates, polyphenolic compounds, organic acids, suspended material, colloids, and numerous other constituents. Reducing part of this bulk is expected to alter bitterness, astringency, viscosity, odor persistence, and ease of ingestion independently of the principal alkaloid profile. These are measurable preparation outcomes rather than abstract qualitative properties.

Whole-plant status in this framework is defined by direct botanical extraction and retention of a broad phytochemical profile rather than by maximal retention of total solids. The relevant analytical variable is therefore phytochemical recovery relative to matrix reduction.

11. Future Analytical Evaluation

The central analytical comparison should use identical botanical lots divided between conventional and matrix-reduced processing. DMT, harmine, harmaline, and THH should be quantified in the starting botanical materials and in both final preparations because plant-to-plant variation can exceed the magnitude of differences introduced by extraction technology [5–7,37]. Total dry matter should be measured before and after matrix reduction, allowing the retained alkaloid mass to be expressed relative to total final solids.

Broader chemical profiling should quantify major carbohydrates, organic acids, polyphenolic markers, minor β-carbolines, and suspended solids. Rodríguez et al. provide a direct analytical model for distinguishing soluble and suspended fractions and demonstrate why total matrix must be considered alongside major alkaloids [19]. Evaporation temperature, pressure, evaporation rate, degree of ethanol removal, clarification method, and separation threshold constitute process variables to be evaluated against alkaloid recovery, total dry-matter reduction, and preservation of the broader phytochemical profile.

A direct practical comparison should record preparation duration, thermal exposure, water consumption, total dry-matter yield, final liquid volume, viscosity, suspended solids, bitterness, astringency, ease of ingestion, nausea, vomiting, frequency of vomiting, abdominal discomfort, and diarrhea. The cultural interpretation of purging should be recorded separately from its physiological occurrence because the same event may be therapeutically desirable in one tradition and undesirable in another [32].

Experiential comparison should additionally characterize onset, overall intensity, duration, visual, bodily, emotional, and cognitive effects, together with perceived similarity to the established preparation. A dry-form comparison can separately evaluate conventional liquid ayahuasca, matrix-reduced liquid ayahuasca, and matrix-reduced dry whole-plant extract.

The target outcome is preservation of the characteristic alkaloid and broader phytochemical profile at a lower total dry-matter burden, with sensory and gastrointestinal tolerability evaluated in parallel.

12. Conclusion

Ayahuasca is a chemically complex whole-plant preparation in which the pharmacologically central DMT–β-carboline system is embedded within a substantially larger soluble, colloidal, and suspended botanical matrix. The physical magnitude of this matrix is therefore a distinct technological variable rather than an intrinsic requirement for preservation of botanical identity.

The proposed matrix-reduced approach combines the established aqueous co-extraction of *B. caapi* and *P. viridis* with hydroethanolic extraction conditions independently shown to be compatible with both source plants. It retains the classical botanical pair as the direct source of DMT, harmine, harmaline, THH, minor β-carbolines, polyphenolic constituents, and broader plant chemistry while introducing controlled matrix reduction as a separate processing objective.

The central experimental question is therefore the relationship between matrix reduction and phytochemical recovery. Quantitative mass-balance analysis of the liquid and separated fractions, together with alkaloid and broader metabolomic profiling, can determine whether substantial physical matrix reduction is achievable without materially altering the characteristic whole-plant profile. If confirmed experimentally, this approach would define a preparation technology between concentrated traditional decoction and molecular reconstruction, with the potential to reduce processing burden and gastrointestinal exposure while preserving the botanical architecture of ayahuasca.

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