

O. L. Zayarnyuk<sup>1</sup>, B. H. Sobetov<sup>2</sup>, A. M. Krychkovska<sup>1</sup>, T. V. Romanovska<sup>1</sup><sup>1</sup>Lviv Polytechnic National University,

Department of Technology of Biologically Active Substances, Pharmacy and Biotechnology

<sup>2</sup>PE "Sobet&Co", Lviv, Ukraine

nataliia.l.zaiarniuk@lpnu.ua

## HOMEOPATHIC MEDICINE BASED ON *CARAPICHEA IPECACUANHA* FOR THE TREATMENT OF ALCOHOLISM

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Based on the results of the SWOT-analysis, the prospects and strategy for the development of a homeopathic medicinal product based on ipecacuanha are substantiated. It was found that there is only one domestic complex drug on the pharmaceutical market. It is shown that reduction of the cost and improvement of the quality of the starting material is possible with the use of biotechnological methods. Ultrasonic filtration is proposed to obtain the matrix tincture. It has been established that a homeopathic remedy with ipecacuanha can be a means of additional therapy at the stage of detoxification and the formation of patient's alcohol aversion. The necessity of additional research and improvement of quality control methods is proved.

**Key words:** pharmacy; herbal medicines; homeopathy; marketing research; treatment of alcoholism.

### Introduction

An essential feature of chronic alcoholism is the loss of the protective gag reflex. Therefore, conditioned reflex therapy, which combines alcohol with antiemetics, is the most common treatment method. The list of stimuli that cause vomiting associated with alcohol consumption includes biologically active substances (BAS), such as apomorphine, emetine, heavy metal salts, etc.; as well as medicinal plants: thermopsis (*Thermopsis*), thyme (*Thymus*), huperzia selago (*Huperzia selago*, *Lycopodium selago*), common centaury (*Centaurium erythraea*), lovage (*Levisticum officinale*), noble laurel (*Laurus nobilis*), wormwood (*Artemisia absinthium*), etc. Among these plants, an important place is occupied by ipecacuanha (the common name is *Carapichea ipecacuanha*, there are six other synonymous names, the most common is *Cephaelis ipecacuanha*).

Ipecacuanha (ipecac) has been known as a medicinal plant in medical practice for a long time, since the 16th century. Modern pharmacy uses herbal medicines from the root of *C. ipecacuanha*, as well as alkaloids derived from it, in particular emetine and cephaelin [1]. Emetine is not a first choice drug and is used as a reserve drug for severe forms of intestinal and

extraintestinal amoebiasis and severe diseases such as schistosomiasis and opisthorchiasis caused by flatworms (*Platyhelminthes*) [2]. Emetine causes amoebic nuclei degeneration, cytoplasmic reticulation, and disruption of protein translation mechanisms. This activity is used in biotechnological research to block protein synthesis in eukaryotic cells. The alkaloids emetine and cephaelin have proven to be pharmacologically active as expectorants, antiemetics, anti-diarrhoea, antiviral (Zika virus, Ebola virus, Dengue virus), antimalarials, anticancer drugs and have prospects in the treatment of leishmaniasis [3]. Ipecacuanas have long been used to treat dysentery, bronchitis, worms, blood diseases, leukemia, cancer, teething problems in children, as an expectorant and emetic. In folk medicine, it is used externally for poisonous insect and scorpion bites. The products affect the nervous system and indirectly the cardiovascular system [1, 4]. One of the side effects is the body's rejection of alcohol due to the ability of the drugs to block the enzyme aldehyde dehydrogenase. This property has become the basis for their use as aversive agents in the treatment of alcohol dependence [1].

For a long time, Ipecac Syrup was sold without a doctor's prescription in many advanced countries.

The experience of using ipecac is long, complications are documented and serious consequences are rare. However, recently, the medical use of Ipecacuanas has decreased. Common side effects of ipecacuanas, emetine and cephaelin include nausea, vomiting and muscle pain. Ipecac syrup can cause lethargy, drowsiness, diarrhea, fever, and irritability. More severe complications are known: aspiration pneumonia, ruptures of the gastroesophageal canal and stomach. Abuse of ipecac can lead to cardiomyopathy. Ipecacuanas herbal medicines are no longer recommended for routine use due to toxicity [5].

However, at present, Ipecac remains a component of a large number of homeopathic medicinal product (HM). Compared to conventional drugs, the doses of HM are subthreshold, which means that these drugs do not have toxic effects. Numerous alternative medicine clinics offer the use of homeopathic medicines based on ipecacuanha (HMIP) to treat many diseases (e. g., Medical Centre “Alternatyve”, <https://mc-alternativa.com.ua/gomeopatychne-likuvannya-doczilnist-gomeopatiyi-perevagy-metody-u-kyyevi>). According to the information posted on their websites, HMIP can be used for respiratory tract diseases: mucus accumulation, spasm, voice loss, asthma, and even whooping cough and bronchopneumonia. The HMIP can be used for gastrointestinal diseases: early-stage gastric catarrh, diarrhoea, dysentery and vomiting in pregnant women. The next group of diseases for which HMIP can be used is diseases of the nervous system. HMIP can help with headaches, including migraines, fever, acute inflammatory processes and haemorrhages. In addition, HMIP can be used as a homeopathic remedy for eye ailments such as ulcers, inflammation of the choroid and cornea. Root of *C. ipecacuanha* is absolutely contraindicated in children under 6 months of age, patients in coma or with epileptic seizures, after swallowing caustic substances, hard and sharp objects, in the absence or impairment of the gag reflex [6, 7].

The possibility of HM using in the treatment of alcohol dependence has been known for a long time and has been proven by research [8-11]. However, in Ukraine, the only homeopathic anti-alcohol drug is ProProTen-100, manufactured by UAB “Santonika” (Lithuania). ProProTen-100 contains 3mg of affinity-purified antibodies to brain-specific protein S-100, as well as excipients. The drug reduces the

manifestations of the “hangover” syndrome and reduces the likelihood of relapse, but does not reduce the craving for alcohol. So, the development of a domestic HMIP for the treatment of alcoholism is relevant.

It should be noted that despite the fact that homeopathy is considered a harmless intervention due to the use of ultra-low doses of biologically active substances (BAS), pharmacotherapy with HM is associated with certain risks. A particular risk is posed by the practice of using HM itself. This is because it allows for homeopathic exacerbation – a temporary deterioration in the patient’s condition that occurs before improvement. Therefore, the risk assessment of the HM is extremely important [12, 13].

**The aim of this study** is to assess the prospects of developing a new HMIP for use in the treatment of alcoholism, and to establish its place in pharmacotherapy.

#### **Materials and research methods**

We chose SWOT-analysis as a method for assessing (researching) the prospects for the development of the HMIP and its further implementation, as well as the risks associated with it.

SWOT-analysis is an analytical method used in pharmacy to study the state of firms, enterprises, their competitive environment, opportunities and threats from the market in order to determine marketing goals, strategies and specific measures. Recently, the scope of application of this method has expanded significantly. SWOT-analysis is used to evaluate and determine development strategies for various projects, scientific directions, analysis of human personality in psychology, etc. [14, 15]. The main advantage is that SWOT-analysis makes it possible to formulate disparate and unsystematic information in the form of a logically consistent scheme of interaction between opportunities and threats, strengths and weaknesses.

We have developed a matrix of SWOT analysis of the development (introduction) of a homeopathic medicine in Ukraine from the point of view of the manufacturer (Table 1).

Other research methods included bibliometric analysis of regulatory documents and scientific publications, marketing research of the pharmaceutical market of Ukraine in terms of the retail segment of homeopathic and anti-alcohol products, laboratory methods for obtaining matrix homeopathic

tincture *C. Ipecacuanha*, comparative analysis of optimal solutions at all stages of the production of HMIP, as well as strategies for providing patients with high-quality HM in accordance with the SWOT-analysis matrix.

The materials for the bibliometric analysis were regulatory legal acts (documents), patents and scientific publications related to HM in general, to the *C. ipecacuanha* as an HMP, its active substances, herbal medicines based on it, as well as HMIP.

It should be noted that the Law of Ukraine “On Medicinal Products” of 2022 is the basic document for activities related to the creation, production, quality control and sale of any medicinal products [16]. According to this Law, a HM is “made from homeopathic raw materials in accordance with the procedure for manufacturing a homeopathic medicinal product defined by the State Pharmacopoeia of Ukraine (SPU), or the European Pharmacopoeia, or the pharmacopoeias of the member states of the European Union, or the United Kingdom, or the Homeopathic Pharmacopoeia of the United States of America”. And since 2018, the SPU for the first time contains a general article on homeopathic dosage forms and separate monographs on homeopathic medicines [17].

The materials we reviewed also covered the risks of HM, methods of obtaining medicinal plant raw materials, technical conditions for obtaining HMIP, and features of use.

The market research included an analysis of the HM, homeopathic ipecacuanas-based medicines and HM for the treatment of alcoholism, which are available on the Ukrainian pharmaceutical market. We also conducted a field study of the availability of such medicines in pharmacies in Lviv (Table 3).

Laboratory studies included obtaining samples of homeopathic matrix tincture from the *C. Ipecacuanha* root according to the methods given in various pharmacopoeias [17–19]. Samples of the matrix tincture were obtained by maceration, extraction in the Soxhlet extractor, extraction in the Jeken PS-08 ultrasonic bath. The control of the starting materials and the obtained tinctures was carried out according to the methods given in the SPU [17, 19], the presence of alkaloids was also confirmed by well-known qualitative reactions (with hydrochloric acid, Dragendorff’s reagent, Lugol’s reagent, etc.) and by thin-layer chromatography in the

UV range, eluent: chloroform-methanol in a ratio of 85:15, treatment: iodine solution in chloroform.

### Result and discussion

The analysis of the elements of the SWOT-analysis matrix presented in Table 1 showed that there are many opportunities to provide patients with quality HM.

HM are recognised in Ukraine, classified as medicinal products, authorised for use and available on the Ukrainian pharmaceutical market. Their definition, requirements for manufacturing and registration are given in the Law of Ukraine “On Medicinal Products” [16]. The state registration of homeopathic medicinal products intended for oral and topical use is carried out under a simplified procedure under the following conditions: the degree of dilution is sufficient to ensure its safety, and the active substance is used in an allopathic medicinal product sold on prescription. Dosage forms are intended for oral, injectable, sublingual, rectal and topical use and are used to treat or prevent diseases based on the principle of similarity.

The raw materials (RM) for the manufacture of HM may include plant materials, minerals and synthetic compounds, raw materials of animal and human origin. Requirements for HM, raw materials for their production, pharmacopoeial articles on their manufacture, as well as quality control methods are given in the SPU [17]. The monographs presented in the SPU (15 separate monographs) contain substances of inorganic origin, except for the monograph on petroleum ether. The volume of substances of various origins and the amount of drugs used in homeopathy probably requires the development of an independent homeopathic pharmacopoeia of Ukraine, similar to other countries, such as the USA homeopathic pharmacopoeia.

Homeopathic therapy has in its arsenal a sufficient number of medicines for the treatment of alcoholism: Aconite, Belladonna, Nux vomica, Arsenicum album, Sulphur, Lachesis mutus, Opium, Cannabis indica, Agaricus mascarius, Lycopodium clavatum, Phosphorus, Lachesis, Ranunculus bulbosus, Staphisagria, Petroleum and others. Each of these means has its purpose, in particular, Nux vomica has an emetic effect [8–10]. There are not many studies of their effect, but they exist. For example, a randomised, controlled, comparative, open-label study

of the treatment of alcohol dependence with the help of HM and allopathic medicines conducted for two years by the Central Council for Research in Homoeopathy at its Central Research Institute (Kottayam, Kerala, India) showed that such HM as Sulphur, *Lycopodium clavatum*, *Arsenicum album*,

*Nux vomica*, *Phosphorus* and *Lachesis* were not inferior to known allopathic pharmaceuticals [11]. In general, homeopathy not only treats alcohol dependence, but also solves such alcohol-related problems as lifestyle changes and helps not only patients but also their families [20].

Table 1

**Matrix of SWOT analysis of HM**

SWOT-analysis components	Opportunities (Goals)	Threats (Risks)
	A. providing patients with high-quality homeopathic medicines	a) low-quality homeopathic drugs reaching patients, low quality plantraw materials due to production problems; capture of the market in Ukraine by foreign manufacturers
	B. use of innovative technologies	b) rising prices for raw materials and finished products
	C. development and research of new HM	c) mistrust of the population, the need to prove efficiency and promotion
	D. reducing product prices without losing quality	d) changes in price components
Strengths of HM	SO-strategies	ST-strategies
I. HM do not cause addiction and pharmacological dependence, as they are not included in the metabolic processes of the body	– increasing tracking ability (B, C, I, II, III, V). – optimization of the production process (A, B, C, IV). – integration of innovative technologies and modern equipment for the development of new high-quality and effective drugs (A, B, C, V)	– support of Ukrainian manufacturers and suppliers of raw materials (a, b, d, IV) – carrying out educational activities on familiarization with drugs (c, I, II, III, V) – development of new methods of processing and purification of raw materials (b, d, I, II, III) – conducting promotions and creating special offers for the public (a, c, I, IV)
II. HM do not have an allergic effect on the body due to the use of extremely small doses of active substances		
III. The possibility of side effects is minimized		
IV. There are a large number of manufacturing companies		
V. BAS are in medicines in a compact form, they are suitable for transportation and storage		
Weaknesses of HM	WO-strategies	WT-strategies
1. HM do not belong to evidence-based medicine	1) market monitoring suppliers and selection the most optimal for price-quality category (D, I). 2) development of the HM database and its regular updating in accordance with new research (A, B, C, I, 3)	1) control over the quality of raw materials and the production process (d, 3). 2) improvement of technology preparation of HM (4, 2, b)
2. HM contain components of animal origin		
3. There is no separate homeopathic pharmacopoeia of Ukraine, there are not enough monographs on HM		
4. HM do not act directly on the focus of the disease, but on the whole body		

HM is available on the Ukrainian pharmaceutical market. Our marketing research made it possible to establish that 48 HM from different countries were available in Ukrainian pharmacies (Figs. 1, 2). The list of HM available on the market according to the websites of pharmacy chains, such as: “Zdravytsia” <https://zdravica.ua/gomeopatichn-zasobi>, “1st social pharmacy” <https://1sa.com.ua/gomeopaticheskie-preparaty/>, “Good Day Pharmacy” <https://www.add.ua/ua/medicamenti/gomeopatiya/>, “9-1-1 Pharmacy” [https://apteka911.ua/ua/shop/lekarstvennyie-preparaty/gomeopaticheskie\\_](https://apteka911.ua/ua/shop/lekarstvennyie-preparaty/gomeopaticheskie_) and etc. It was also found that out of these 48 products, 6 contain ipecacuanha (Table 2).

ua/shop/lekarstvennyie-preparaty/gomeopaticheskie\_ and etc. It was also found that out of these 48 products, 6 contain ipecacuanha (Table 2).

In Ukraine, there is the “National Homeopathic Union” PJCK, which has become a leader in the production of homeopathic products. In 2010, the company opened its own plant for the production of HM in Lubny, Poltava region, which produces 21 complex homeopathic medicines. However, there is currently no homeopathic pharmacopoeia in Ukraine.

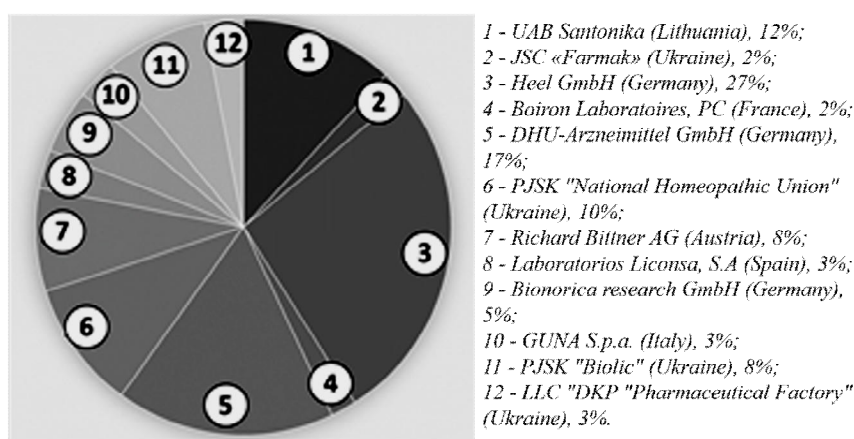


Fig. 1. Pharmaceutical companies – manufacturers of HM presented on the Ukrainian market (date of application: 02.26.2024).

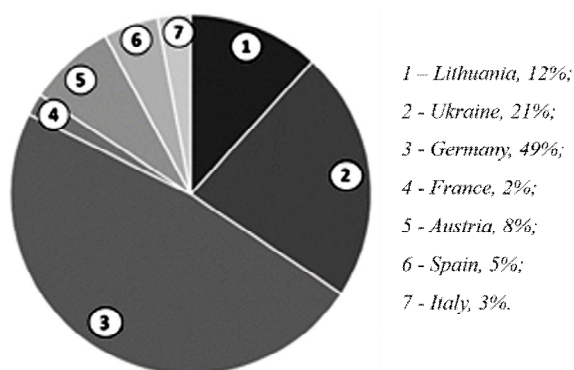


Fig. 2. Countries-manufacturers of HM represented on the market of Ukraine (date of application: 02.26.2024).

The SPU contains monographs on ipecacuanas root, standardised liquid extract, and standardised tincture [19]. Ipecac is standardised by the content of alkaloids, but ipecac also contains other BAS, which is confirmed by the results of research [1]. List of components of the root *C. Ipecacuanha* root and the averaged values of the percentage content are given in Table 3.

Dried Ipecacuanas roots contain isoquinoline alkaloids, the most important and studied of which are emetine and cephaeline, psychotrin is also present (Fig. 3, a, b, c). O-methylpsychotrin, emetamine and protoemetine have been identified. Other substances are present: tannins, in particular ipecacuanic acid; isoquinoline monoterpene glycosides, in particular ipecoside and desacetyl-ipecoside, choline, organic

acids. Research is ongoing, with different scientists coming up with not the same results. For example, earlier it was published that the plant contains saponosides, but now this fact has been refuted. At the end of the XIX century, pharmacists expressed dissatisfaction with

galenic preparations of ipecacuanas because of the unstable composition of the BAS. Thus, two samples of the root had the same total alkaloid content, but the sample from Brazil contained about 72 % emetine, and the sample from Colombia – about 40 % [1, 2].

Table 2

**Homeopathic preparations containing ipecac in Lviv pharmaces (as of 02.26.2024)**

No.	Dosage form and composition of the HM	Application method and dosage	Indications for use	Price, UAH
1	2	3	4	5
Influcid, DHU, Germany, UA/6740/01/01 dated 08.11.2017 order No. 2378 dated 29.12.2022				
	1 tablet contains: Aconitum D3 – 25 mg, Gelsemium D3 – 25 mg, Ipecacuanha D3 – 25 mg, Phosphorus D5 – 25 mg, Bryonia D2 – 25 mg, Eupatorium perfoliatum D1 – 25 mg	In case of an acute condition: for children aged 1–12 years, 1 t. every 2 hours. (no more than 8 tablets per day); children aged 12 and over and adults – 1 tablet each. every hour (no more than 12 per day), then 1–2 tons 3 times a day). For prevention: 1 tablet for children aged 1–12 years. 3 times a day; children aged 12 and over and adults 1–2 tablets each. 3 times a day	Prevention and treatment of flu-like infections and other SARS accompanied by fever	Tabl. No. 40 From 199,60 to 220.20 Tabl. No. 60 245.40
2 Stodal, Laboratoires Boiron, France, UA/9346/01/01 dated 16.04.2019 order No. 773 dated 25.04.2023				
	100 g of syrup contains: Antimonium tartaricum 6 CH – 0.95 g, Bryonia 3CH – 0.95 g, Coccus cacti 3CH – 0.95 g, Drosera MT – 0.95 g; Ipeca 3CH – 0.95 g; Myocardium 6CH – 0.95 g; Pulsatilla 6CH – 0.95 g; Rumex crispus 6CH – 0.95 g; Spongia tosta 3CH – 0.95 g; Sticta pulmonaria 3CH – 0.95 g	For oral use: adults – a single dose of 15 ml, 3–5 times a day; children over 2 years old – a single dose of 5 ml, 3–5 times a day; children – can be used for children aged 2 and over. The duration of treatment is determined by the doctor individually	Complex symptomatic treatment of productive and unproductive cough in adults and children	200 ml from 218.99 to 324.72
3 Bronchalis, Heel, Germany, UA/1932/01/01 dated 17.01.2020 order No. 1886 dated 19.10.2022				
	1 tablet contains: Atropa bella-donna D4 – 30 mg, Bryonia D4 – 60 mg, Cephaelis ipecacuanha D4 – 30 mg, Hyoscyamus niger D4 – 60 mg, Kalium stibyltartaricum D4 – 30 mg, Kreosotum D5 – 30 mg, Lobaria pulmonaria D4 – 30 mg, Lobelia inflata D4 – 30 mg	Adults and children over 6 years old – 1 tablet. under the tongue, for children aged 3–6 years – 1 tablet. grind into a powder and dissolve in 20 ml of boiled water at room temperature, and take a single dose: 2 teaspoons. Take 3 times a day for 15–20 minutes. before meals or after 1 hour	Acute, chronic inflammatory and obstructive diseases of the respiratory tract, bronchitis, pleurisy, tracheitis, smoker's cough, bronchial asthma	Tabl. No. 40 from 218.00 to 364.32
4 Mucoza compositum, Heel, Germany, UA/2946/01/01 dated 02.07.2020 order No. 2128 dated 01.10.2021				
	Solution for injection, 2 ml of solution contain: Argentum nitricum D6 – 22 µl, Atropa bella-donna D10 – 22 µl, Ceanothus americanus D4 – 22 µl, Cephaelis ipecacuanha D8 – 22 µl, Colibacillinum Nosode D28 – 22 µl, Hydrastis canadensis D4 – 22 µl, Kalium bichromicum D8 – 22 µl, Kreosotum D10 – 22 µl, Lachesis D10	Single dose: adults and children over 2 years old – 1 ampoule of 2.2 ml. Apply in the form of intramuscular, subcutaneous, intradermal, and if necessary – intravenous injections, usually 1–3 times a week. In case of an acute condition – a single dose daily for 2–3 days. The course of treatment is 2–5 weeks	Treatment of inflammatory and erosive-ulcerative processes of mucous membranes of the gastrointestinal tract, genitourinary tract, upper and lower respiratory tract, as well as intestinal dysbiosis	2.2 ml of No. 5 in amp. from 950.00 to 1381.90

1	2	3	4	5
	– 22 µl, Mandragora e radice siccata D10 – 22 µl, Marsdenia cundurango D6 – 22 µl, Momordica balsamina D6 – 22 µl, Mucosa coli suis D8 – 22 µl, Mucosa ductus choledochi suis D8 – 22 µl, Mucosa duodeni suis D8 – 22 µl, Mucosa ilei suis D8 – 22 µl, Mucosa jejuni suis D8 – 22 µl, Mucosa nasalis suis D8 – 22 µl, Mucosa oculi suis D8 – 22 µl, Mucosa oesophagi suis D8 – 22 µl, Mucosa oris suis D8 – 22 µl, Mucosa pulmonis suis D8 – 22 µl, Mucosa pylori suis D8 – 22 µl, Mucosa recti suis D8 – 22 µl, Mucosa vesicae felleae suis D8 – 22 µl, Mucosa vesicae urinariae suis D8 – 22 µl, Natrium diethyloxa-laceticum D8 – 22 µl, Oxalis acetosella D6 – 22 µl, Pankreas suis D10 – 22 µl, Phosphorus D8 – 22 µl, Pulsatilla pratensis D6 – 22 µl, Semecarpus anacardium D6 – 22 µl, Strychnos nux-vomica D13 – 22 µl, Sulfur D8 – 22 µl, Ventriculus suis D8 – 22 µl, Veratrum album D4 – 22 µl			
5	Ovarium compositum, Heel, Germany, UA/3973/01/01 dated 08.07.2020 order No.2022 dated 28.11.2023			
	Solution for injection, 2 ml of solution contain: Acidum cis-aconiticum D10 – 22 mg, Apisinum D8 – 22 mg, Aquilegia vulgaris D4 – 22 mg, Calvatia gigantea D6 – 22 mg, Cypridium parviflorum var. pubescens D6 – 22 mg, Hydrastis canadensis D4 – 22 mg, Hypophysis suis D13 – 22 mg, Kreosotum D8 – 22 mg, Lachesis D10 – 22 mg, Lilium lancifolium D4 – 22 mg, Magnesium phosphoricum D10 – 22 mg, Mercurius solubilis Hahnemanni D10 – 22 mg, Ovarium suis D8 – 22 mg, Placenta totalis suis D10 – 22 mg, Psychotria ipecacuanha D6 – 22 mg, Pulsatilla pratensis D18 – 22 mg, Sepia officinalis D10 – 22 mg, Tuba uterina suis D10 – 22 mg, Uterus suis D10 – 22 mg	Single dose: adults and girls of puberty age – 1 ampoule of 2.2 ml. Apply in the form of intramuscular, subcutaneous, intradermal, and if necessary – intravenous injections 1–2 times a week. Depending on the characteristics of the course of the disease and the patient’s condition, the doctor can change the duration of the treatment course and the method of application. The course of treatment is 4–6 weeks	Dysmenorrhea, endometritis, metritis, parametritis, insufficiency of the function of the anterior lobe of the pituitary gland, kraurosis of the vulva, climax, mastopathy, osteomalacia, menorrhagia, various metabolic disorders associated with a decrease in the synthesis of female sex hormones, including geriatric	2.2 ml of No. 5 in amp. from 864.50 to 1381.00
6	Broncho-Gran, National Homeopathic Union, Ukraine, UA/2946/01/01 dated 02.07.2020 order No. 2128 dated 01.10.2021			
	10g granules contain: Bryonia alba 200CH – 20 mg; Spongia 200CH – 20 mg; Ipecacuanha 200CH – 20 mg; Verbascum 50CH – 20 mg; Kalium bichromicum 200CH – 20 mg	Adults and children aged 7 years old receive 7 granules, children aged 3–7 years old receive 1 granule at the age of life. The doctor’ dose should be taken within 15–20 minutes. before or after 1 year. after. Take 2–6 times per dose, slowly depending on the severity, until you get ready again	Diseases of the upper respiratory tract accompanied by cough; treatment and prevention of relapses of laryngitis, tracheitis, bronchitis	granules of 10 g in a package from 106.00 to 227.70

Table 3

**Component composition of plant RM roots**  
*C. Ipecacuanha*

No.	Name of substance	Content, %
1	Isoquinoline alkaloids, including	3–4
	Emetine	до 2
	Cephaelin	0.25
2	Isoquinoline-monoterpene glycosides	1
3	Tanning substances	1
4	Saponins	1
5	Mineral substances	4–5
6	Starch	30–40
7	Water	5–10

The raw material is the root of *C. Ipecacuanha*, which grows in Central and South America: in northern Brazil, Colombia, Nicaragua, and Panama. The root is even among the three main export crops in Costa Rica, along with coffee and banana [21]. The plant is cultivated in Asia: India, Malaysia, Burma, and New Zealand. Global production of the root is more than 100 tonnes per year [22].

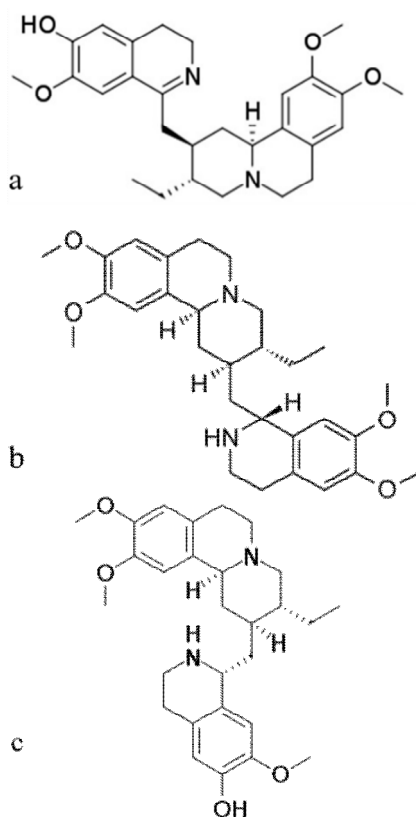


Fig. 3. Main alkaloids of ipecac:  
a – psychotrine; b – emetin; c – cephaelin

It should be noted that *C. Ipecacuanha* is an endangered plant due to climate change, deforestation and predatory collection. Ipecacuanha is a slow-growing plant, its seed propagation is unreliable due to poor germination, and vegetative propagation is difficult as young shoots are damaged by insects and the soil fungus *Fusarium solani*. To preserve the resources of this plant and efficiently synthesise secondary metabolites, scientists are initiating various programmes using in vitro methods. Collections of germplasm of this plant from different regions of South and Central America have been created. Methods of micropropagation of *C. Ipecacuanha*, methods using callus cultures, hairy roots, hybrids and transformed cultures have been developed [22–24]. All of these methods make it possible to produce more attractive commercially cultivated plants.

So, although the technology for obtaining matrix tincture is simple (Fig. 4), problems begin at the stage of selecting natural-origin raw materials. The methods of obtaining the HM are very conservative, but there is room for improvement at every stage of the technology.

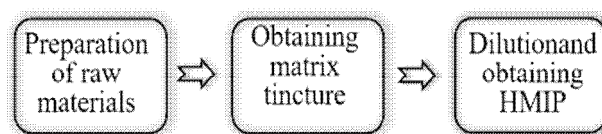


Fig. 4. Block-scheme of obtaining HM

Traditionally, homeopathy uses the method of maceration, which involves stirring, to prepare a matrix tincture. However, according to the SPU, a matrix tincture can be produced by maceration, infusion, percolation, fermentation, or another suitable method. In our opinion, a more intensive and advanced method is ultrasonic extraction. It is based on the use of ultrasonic waves to create mechanical vibrations that contribute to the rupture of the cell walls of plant material and allow for faster achievement of the full release of the BAS. The results of patent inspection showed the possibility of using ultrasonic extraction for the industrial production of tincturae from *C. Ipecacuanha* [25]. The results of our laboratory studies showed the unsuitability of extraction in a Soxhlet apparatus and the advantage of ultrasonic extraction compared to maceration. The use of an ultrasonic bath Jeken PS-08 made it possible to



reduce the time to obtain an extract to 1.5–3.0 hours. In contrast to maceration, which lasted at least 7 days. Consequently, this method could also be used for extemporaneous production of the extract in pharmacies.

HM contain negligibly small amounts of BAS, which manifest their properties only through special processing. Grinding brings the substance into a highly dispersed state, and subsequent dilutions help to dissociate the molecules. The HM particles acquire new properties, they become surface-active, their catalytic properties increase, and their effect on receptors is enhanced. By choosing the necessary dilution, a homeopathic physician can change the dose of the medicine and thus influence the course of the disease.

Quality control procedures are standardisation procedures by which the quality of a medicine is checked. The quality should not only be checked at the end, but should also be performed from the moment of receipt of raw materials, during the manufacturing process, to the final packaging, labelling, storage and distribution stages. HM can be based on toxic material from animals or plants. When fresh, they are prone to microbial contamination. The properties of foods may be impaired by accidental or deliberate contamination of the containers in which they are diluted. The products can be falsified. Quality control is essential and requires the use of modern analytical methods [17, 26, 27].

The World Health Organisation states that the use of homeopathy has no evidence base and warns against homeopathic treatment of infectious and any other serious diseases [28]. However, HM are used and officially registered in Ukraine.

The path to recovery for a patient with alcoholism always has two main stages: detoxification, which is necessarily carried out by a doctor in a clinic or, as an exception, in groups or at home; and rehabilitation, during which a specialist chooses an individual recovery programme. Complementary therapy is ideal for solving withdrawal problems and substitution therapy. Traditionally, homeopaths consider alcoholism as a disease of the nervous system. For example, *Nux vomica* has long been used in the treatment of alcoholism. This herb contains strychnine, which is a strong stimulant of the brain, medulla oblongata and spinal cord, and all sensory organs. It is one of the main regulators of the nervous

system, which has been brought into an irritated state by excessive work, an unhealthy lifestyle, smoking and alcohol abuse. The cause of the disease is not always known, so homeopathic complex preparations are used, as well as preparations containing BARs in allopathic and homeopathic doses. However, we now understand that this disease is more complex and depends on many factors, including heredity, the presence of a certain gene, metabolic characteristics, etc. It is the course of biochemical reactions in the body that HMIP will affect.

It is clear that homeopathy is only a component of quality treatment. Complete remission can only be achieved by combining pharmacotherapy, homeopathy, psychological treatment, exercise and social support.

### Conclusions

Based on the results of the SWOT-analysis, the prospects and strategy for the development of a new homeopathic medicine are substantiated.

The results of the market research revealed that there is a sufficient number (23 %) of domestic HM on the pharmaceutical market, but only one complex HM containing *C. ipecacuanha*.

Based on a bibliometric study, it is shown that the reduction in the cost and improvement of the quality of raw materials is possible with the use of biotechnological methods: monoclonal propagation, the use of callus cultures, and culture medium that contain precursors of bioactive substances.

Based on the analysis of patents and our own laboratory studies, it is proposed to use ultrasonic filtration to optimize production of HMIP to obtain a matrix tincture.

It has been shown that HMIP can be a means of complementary therapy at the stage of detoxification and the formation of patient aversion to alcohol. However, it is necessary to conduct additional structured studies and improve the methods of controlling the finished HMIP.

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**Н. Л. Заярнюк<sup>1</sup>, Б. Г. Собетов<sup>2</sup>, А. М. Кричківська<sup>1</sup>, Т. В. Романівська<sup>1</sup>**

<sup>1</sup> Національний університет “Львівська політехніка”,  
кафедра технології біологічно активних сполук, фармації та біотехнології  
<sup>2</sup> ПП “СобетіК”

### **ГОМЕОПАТИЧНИЙ ЗАСІБ НА ОСНОВІ *CARAPICHEA IPECACUANHA* ДЛЯ ЛІКУВАННЯ АЛКОГОЛІЗМУ**

На основі результатів SWOT-аналізу обґрунтовано перспективність та стратегію розроблення гомеопатичного засобу на основі іпекакуани. Виявлено, що на фармацевтичному ринку є лише один вітчизняний комплексний препарат. Показано, що здешевлення та покращення якості вихідної сировини можливі із застосуванням біотехнологічних методів. Запропоновано для одержання матричної настоянки використовувати ультразвукову фільтрацію. Встановлено, що гомеопатичний засіб з іпекакуаною може слугувати засобом додаткової терапії на етапі детоксикації та формування у пацієнта неприйняття алкоголю. Доведено необхідність додаткових досліджень та покращення методик контролю якості.

Ключові слова: аптека; фітопрепарати; гомеопатія; маркетингові дослідження; лікування алкоголізму.