DEVELOPMENT OF A TECHNOLOGY FOR OBTAINING DRY EXTRACT WITH A TINCHING EFFECT

Tuychieva Shakhodat Saydamin kizi
KIUT (Kimyo International University in Tashkent) 2nd-year Master's student

Abstract. Research on the development of a technology for obtaining a dry extract containing flavonoids of the H. scabrum plant growing in the territory of the Republic of Uzbekistan is a pressing task. This article discusses the industrial technology for obtaining dry extract of coarse sorrel, in particular, the fractional composition of coarse sorrel raw materials ground in mills with various sieves, the indicators of influencing factors, the use of a spray drying device in obtaining dry extract of coarse sorrel, as well as the naturalness, low side effects, and biological compatibility of preparations obtained from plant raw materials, their advantages of wide application in medical practice.

Keywords: flavonoid, dry extract, chamomile raw material, extraction, alcohol, industrial technology, concentration, time, pressure, medicinal plant, concentration, storage, medical practice.

In the territory of Uzbekistan, 3 species of “Hypericum scabrum”, “Hypericum eloncratum”, and “Hypericum perforatum” grow. However, the raw material reserves of H. eloncratum are very small. The species H. perforatum has been introduced into medical practice. The substance "Dry Dalachoy Extract," obtained from the aerial parts of H. perforatum plants, is an analogue of the imported preparation "Hypericum - Gelarium," which has a sedative and antidepressant effect. However, in the territory of Uzbekistan, the raw material reserves of H. perforatum are less than that of H. scabrum. It should be noted that both species contain the flavonoid hypericin, which is the main active substance. Based on the foregoing, research on the development of a technology for obtaining a dry extract containing flavonoids of the H. scabrum plant growing in the territory of the Republic of Uzbekistan is an urgent task. The literature data indicate that

ethyl alcohol at a concentration of 60% to 80% is indicated as an effective solvent for the extraction of flavonoids from the chamomile plant. However, for technology, this interval is too wide.

The isolation of biologically active substances from plant raw materials is a complex process. Several factors simultaneously influence the efficiency of the extraction process. Therefore, experiments were conducted on the selection of an effective solvent for the extraction of hypericin from the raw material Hypericum scarbum, the influence of the degree of grinding of the raw material and temperature on the extraction process, and the study of the dynamics of the extraction process.

The extraction process can be divided into 2 groups - static and dynamic. When extracting biologically active substances under static conditions, the raw material is soaked in the extractant and then allowed to settle for a certain period. In dynamic extraction, one or both of the solvent and the raw material are set in motion. As a result, during the interaction of phases, the exchange of substances intensifies. This leads to a decrease in the duration of the extraction process and the time of action of the phases. Therefore, in order to further increase the efficiency of the extraction process of hypericin flavonoid from the raw material Hypericum scarbum, such methods of dynamic extraction as with a mobile solvent and constant stirring were studied.

Extraction by mobile solvent method. For this, a pump was installed in an extractor with a capacity of 10 l, 2.0 kg of Hypericum scarbum raw material was loaded, and 8.0 l (hydromodule 1:4) of 80% ethyl alcohol was added. The extract was drawn from the lower part of the extractor by a specially installed pump, and the extractor was drained from the upper part of the extractor at a rate of 200 l/min per 1m3 of volume. The process was carried out until the extractant transfer of the extractive substances ceased during the phase interaction. For this, the yield of extractive substances was analyzed every 30 minutes. After the extraction process, the extract (6.0 l) was poured out, and 6.0 l of 80%

ethyl alcohol was added again, and the extraction process was carried out under the same conditions as the first. Extraction was carried out in this way three more times, and the yield of extractive substances was determined.

Extraction with constant stirring. 1.0 kg of Hypericum scarbum raw material was placed in an extractor with a capacity of 10.0 l and equipped with a mixer. To ensure smooth rotation of the mixer, 10.0 l (hydromodule 1:10) of 80% ethyl alcohol was added, and the extraction process was carried out at room temperature with constant stirring. The yield of extractive substances was analyzed every half hour. After the extraction process was completed, the extract (9.0 l) was poured out, and 9.0 l of 80% ethyl alcohol was added again, and the extraction process was carried out under the same conditions as the first. Extraction was carried out in this way three more times, and the yield of extractive substances was determined.

Remothering method. To compare the statistical and dynamic methods, the raw material Hypericum scarbum was extracted five times at room temperature with 80% ethyl alcohol. When selecting the type of drying of the ethyl acetate solution of flavonoids for obtaining the dry extract of roughage, vacuum and non-vacuum conditions were used.

Experiments were conducted on devices operating under vacuum and non-vacuum conditions, under the influence of infrared radiation, forced ventilation and spray drying.

For this, 5.0 kg of air-dried and ground raw material Hypericum scarbum, ground in a mill with a hole diameter of 4 mm, was placed in an extractor with a capacity of 50.0 l and 20.0 l of 80% ethyl alcohol was added. The extraction process was carried out at room temperature for 6 hours. After the specified time, the first 15.0 l of extract was poured out. 15.0 l of fresh 80% ethyl alcohol was poured into the extractor, and the extraction was carried out under the same conditions as the first extraction. As a result, 15.0 l of the second extract was obtained. In this way, the extraction process was carried

out three more times. Five extracts were combined, and the resulting 75.0 l of extract was filtered and thickened until 5.0 l remained. At the end of the process, another 5 liters of purified water was supplied to the evaporator to remove the residual ethyl alcohol, and the condensation process continued until 3 liters remained. The resulting aqueous concentrate was treated 5 times with 3 liters of extraction gasoline, followed by the extraction of flavonoids 5 times with 3 liters of ethyl acetate. The ethyl acetate extracts were first combined and then divided into five equal parts (by 5.0 liters). Each piece of ethyl acetate extract was dried on various equipment as follows:

Example 1. The first batch of ethyl acetate extract was condensed in a rotary evaporator until a thick mass was formed and dried in a "SHSV-45K" (Russia) drying oven at 70-80°C under vacuum-free conditions.

Example 2. The second part of the ethyl acetate extract was evaporated until a thick mass was formed and dried in a "SHSV-45K" (Russia) drying oven at a temperature of 70-80°C and a vacuum of 0.6-0.8 kgf/cm2.

Example 3. The third piece of ethyl acetate extract was condensed in a rotary evaporator until a thick mass was formed and dried in a drying cabinet of the "IKS-2M" brand (Russia), under the influence of infrared radiation and at a temperature of 70°C.

Example 4. The fourth piece of ethyl acetate extract was evaporated until a thick mass was formed and dried in a sublimation dryer at a temperature of 80-85°C under a vacuum of 0.9-1.0 kgf/cm2.

Example 5. The fifth piece of ethyl acetate extract was thickened to 1.0 liters in a rotary evaporator. To remove residual ethyl alcohol from the concentrate, 3.0 l of purified water was supplied to the evaporator at the end of the process, and the thickening process was continued until the dry matter content in the drying solution reached 10%. The resulting concentrate (dried solution) was dried in a spray drying unit of the "Anhydro No. 2" (Denmark) under the following conditions: the temperature of

the drying agent (hot air) is 180-190°C, at the outlet 85-90°C; the speed of the injected aqueous solution is 4 l/hour; the pressure of the injected aqueous solution on the spray nozzle is 0.2 MPa.

Due to the fact that the obtained dry extracts of samples 1-4 were in the form of pieces, they were ground in a knife mill and passed through a sieve with a hole diameter of 0.5 mm.

From the presented data, it can be observed that the drying process, carried out by spray drying, took the least time compared to other considered types. By methods 1-4, dry extracts in the form of a non-uniform powder consisting of dark brown and brown particles were obtained. In the 5th method, a dry extract was obtained in the form of a light brown powder with a uniform appearance. In addition, the dry extracts obtained by methods 1-4 undergo the following stages of grinding and sieving. This led to the loss of a certain part of the dry extracts at these stages, including the impossibility of sieving 10-12% of the dry extracts even with 3-4 repeated grinding. In the 2nd and 4th methods, since the dry extracts partially contain porous particles, their grinding was easier. However, in this regard, the 5th method is also superior to others, since at the end of the process, a fine-grained powdered dry extract is obtained, and such processes as grinding and sifting are not required. Another advantage of this type is the low moisture content of the dry extract obtained by the 5th method compared to other types.

Based on the foregoing, it was deemed preferable to use a spray drying unit for obtaining the dry extract of coarse sorrel.

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Annotatsiya. O‘zbekiston Respublikasi hududida o‘sadigan H. scabrum o‘simligining flavonoidlarini saqlagan quruq ekstrakt olish texnologiyasini ishlab chiqish bo‘yicha tadqiqotlar dolzarb vazifa hisoblanadi. Ushbu maqolada dag‘al dalachoy quruq ekstraktini olish sanoat texnologiyasi, xususan, turli elaklar o‘rnatilgan tegirmonlarda maydalangan Dag‘al dalachoy xomashyoni fraksion tarkibi, ta’sir qiluvchi omillarning ko‘rsatkichlari, dag‘al dalachoy quruq ekstraktini olishda purkab quritish qurilmasidan foydalanish, shuningdek, o‘simlik xomashyosidan olingan preparatlarning tabiiyligi, kam nojo‘ya ta’sirga egaligi va biologik mosligi ularning tibbiyot amaliyotida keng qo‘llanilishi afzalliklari haqida fikr yuritiladi.

Kalit so‘zlar: flavonoid, quruq ekstrakt, dalachoy xomashyosi, ekstraksiya, spirt, sanoat texnologiyasi, konsentratsiya, vaqt, bosim, dorivor o‘simlik, konsentratsiya, saqlash, tibbiy amaliyoti.

O‘zbekiston hududida dalachoyning 3 turi - Hypericum scabrum, Hypericum eloncratum va Hypericum perforatum o‘sadi. Biroq, H. eloncratum xomashyo zaxiralari juda kam. Tibbiy amaliyotga H. perforatum turi joriy yetilgan. H. perforatum o‘simliklarining yer ustki qismidan olingan «Dalachoy quruq ekstrakti» substantsiyasi

chet eldan import qilinadigan tinchlantiruvchi va tushkunlikka qarshi ta’sirga ega bo‘lgan «Giperikum - Gelarium » preparatining analogi hisoblanadi. Ammo O‘zbekiston hududida H. perforatum xomashyo zaxirasi H. scabrum dan kam. Shuni ta’kidlash kerakki ikkala turda ham asosiy faol modda bo‘lgan giperitsin flavonoidi mavjud. Yuqoridagilardan kelib chiqqan holda, O‘zbekiston Respublikasi hududida o‘sadigan H. scabrum o‘simligining flavonoidlarini saqlagan quruq ekstrakt olish texnologiyasini ishlab chiqish bo‘yicha tadqiqotlar dolzarb vazifa hisoblanadi. Adabiyot ma’lumotlari shuni ko‘rsatadiki, 60% dan 80% gacha konsentratsiyadagi etil spirti dalachoy o‘simligidan flavonoidlarni ekstraksiya qilish uchun samarali erituvchi sifatida ko‘rsatilgan. Biroq, texnologiya uchun ushbu interval juda keng hisoblanadi.

O‘simlik xomashyosidan biologik faol moddalarni ajratib olish murakkab jarayon hisoblanadi. Ekstraksiya jarayonining samaradorligiga bir vaqtning o‘zida bir necha omillar ta’sir ko‘rsatadi. Shu sababli *Hypericum scarbum* xomashyosidan giperitsinni ekstraksiyasi uchun samarali erituvchi tanlab olish, ekstraksiya jarayoniga xomashyo maydalik darajasi va haroratni ta’siri, ekstraksiya jarayoni dinamikasini o‘rganish bo‘yicha tajribalar olib borildi.

Ekstraksiya qilish jarayonini 2 guruhga bo‘lish mumkin – statik va dinamik. Biologik faol moddalarni statik sharoitda ekstraksiya qilishda xomashyo ekstragentga bo‘ktirib so‘ng ma’lum vaqt davomida tindirib qo‘yiladi. Dinamik sharoitda ekstraksiya qilishda erituvchi va xomashyoning biri, yoki har ikkisi harakatga keltiriladi. Natijada fazalarning o‘zaro ta’siri vaqtida moddalar almashinuvi jadallashadi. Bu holat ekstraksiya jarayonini borish vaqtini va fazalarning ta’sir vaqtini kamayishiga sabab bo‘ladi. Shu sababli *Hypericum scarbum* xomashyosidan giperitsin flavonoidini ekstraksiya jarayonini samaradorligini yanada oshirish maqsadida harakatdagi erituvchi va doimiy aralashtirishli kabi dinamik ekstraksiya usullari o‘rganildi.

Harakatdagi erituvchi usulidagi ekstraksiya. Buning uchun sig‘imi 10 l bo‘lgan

ekstraktorga nasos o‘rnatildi va 2,0 kg *Hypericum scarbum* xomashyosi joylandi va 8,0 l (gidromodul 1:4) 80% li etil spirti quyildi. Ekstraktor quyi qismidan maxsus o‘rnatilgan nasos orqali ekstrakt tortib olinib, ekstraktorning yuqori qismidan ekstraktorni $1m^3$ hajmiga nisbatan 200 l/min tezlik bilan oqizib qo‘yildi. Jarayon fazalar ta’siri vaqtida ekstraktiv moddalarning ekstragent o‘tishi to‘xtaguncha olib borildi. Buning uchun har 30 minutda ekstraktiv moddalar unumi tahlil qilib borildi. Ekstraksiya jarayoni tugagach ekstrakt (6,0 l) quyib olindi va 6,0 l yangidan 80% li etil spirti quyib birinchisi kabi sharoitda ekstraksiya jarayoni olib borildi. Ekstraksiya shu yo‘sinda yana uch marotaba amalga oshirildi va ekstraktiv moddalar unumi aniqlandi.

Doimiy aralashtirishli ekstraksiya. Sig‘imi 10,0 l bo‘lgan va aralashtirgich bilan jihozlangan ekstraktorga 1,0 kg *Hypericum scarbum* xomashyosi joylandi. Aralashtirgichni ravon aylanishini ta’minlash maqsadida 10,0 l (gidromodul 1:10) 80% li etil spirti quyildi va xona haroratida, doimiy aralashtirgan holda ekstraksiya jarayoni olib borildi. Har yarim soatda ekstraktiv moddalar unumi tahlil qilib borildi. Ekstraksiya jarayoni tugagach ekstrakt (9,0 l) quyib olindi va 9,0 l yangidan 80% li etil spirti quyib birinchisi kabi sharoitda ekstraksiya jarayoni olib borildi. Ekstraksiya shu yo‘sinda yana uch marotaba amalga oshirildi va ekstraktiv moddalar unumi aniqlandi.

Rematseratsiya usuli. Statistik va dinamik usulni taqqoslash maqsadida *Hypericum scarbum* xomashyosi 80% li etil spirti bilan xona haroratida besh marta ekstraksiya qilindi. Dag‘al dalachoy quruq ekstraktini olishda flavonoidlarni etilatsetatli eritmasini quritish turini tanlab olishda vakuumsiz va vakuumli sharoitdan foydalanildi.

Vakuumsiz va vakuumli sharoitda, infraqizil nur ta’siri ostida, havoni majburiy shamollatish va purkab quritish kabi sharoitlarda ishlovchi qurilmalarda tajribalar olib borildi.

Buning uchun havoda quritilib maydalangan va teshiklari diametrining o‘lchami 4 mm bo‘lgan tegirmonda maydalanilgan 5,0 kg *Hypericum scarbum* xomashyosi sig‘imi

50,0 l bo‘lgan ekstraktorga joylandi va 20,0 l 80% etil spirti quyildi. Ekstraksiya jarayoni 6 soat davomida xona haroratida olib borildi. Belgilangan vaqt tugagach birinchi 15,0 l ekstrakt quyib olindi. Ekstraktorga 15,0 l miqdorda yangi 80% etil spirti quyildi va birinchi ekstraksiya kabi sharoitda ekstraksiya olib borildi. Natijada 15,0 l ikkinchi ekstrakt olindi. Shu yo‘sinda yana uch marta ekstraksiya jarayoni amalga oshirildi. Beshta ekstrakt birlashtirildi va hosil bo‘lgan 75,0 l ekstrakt filtrlandi va 5,0 l qolguncha quyultirildi. Jarayon so‘ngida qoldiq etil spirtini chiqarib tashlash uchun bug‘latish jihoziga yana 5 l tozalangan suv uzatildi va quyultirish jarayoni 3 l qolguncha davom ettirildi. Hosil bo‘lgan suvli konsentrat 5 marta har biri 3 l bo‘lgan ekstraksion benzin bilan ishlov berildi va keyingi navbatda har biri 3 l bo‘lgan etilatsetat bilan 5 marta flavonoidlar ekstraksiya qilib olindi. Etilatsetatli ajratmalar avval birlashtirildi va so‘ng teng besh bo‘lakka bo‘lindi (5,0 litrdan). Har bir bo‘lak etilatsetatli ajratmalar turli jihozlarda quyidagicha quritildi:

1 - namuna. Birinchi bo‘lak etilatsetatli ajratma quyuq massa hosil bo‘lguncha rotorli bug‘latgichda quyultirildi va “SHSV-45K” (Rossiya) markali quritish shkafida 70-80°C harorat ostida vakuumsiz sharoitda quritildi.

2 - namuna. Ikkinchi bo‘lak etilatsetatli ajratma quyuq massa hosil bo‘lguncha bug‘latildi va “SHSV-45K” (Rossiya) markali quritish shkafida 70-80°C harorat va 0,6-0,8 kgs/sm2 vakuum ostida quritildi.

3 - namuna. Uchinchi bo‘lak etilatsetatli ajratma quyuq massa hosil bo‘lguncha rotorli bug‘latgichda quyultirildi va “IKS-2M” (Rossiya) markali quritish shkafida, infraqizil nur ta’siri va 70°C harorat ostida quritildi.

4 - namuna. To‘rtinchi bo‘lak etilatsetatli ajratma quyuq massa hosil bo‘lguncha bug‘latildi va 80-85°C haroratda, 0,9-1,0 kgs/sm2 vakuum ostida sublimatsion quritgichda quritildi.

5 - namuna. Beshinchi bo‘lak etilatsetatli ajratma rotorli bug‘latish jihozida 1,0

litrgacha quyultirildi. Konsentrat tarkibidagi qoldiq etil spirtini chiqarib yuborish maqsadida jarayon so‘ngida bug‘latish jihoziga 3,0 l tozalangan suv berildi va quyultirish jarayoni quritilayotgan eritma tarkibida quruq moddalar miqdori 10%-ga yetguncha davom ettirildi. Hosil bo‘lgan konsentrat (quritilayotgan eritma) quyidagi sharoitda “Anhydro No. 2” (Daniya) markali purkab quritish qurilmasida quritildi: quritish vositasinig (issiq havo) harorati 180-190°C, chiqishda 85-90°C; yuborilayotgan suvli eritmani tezligi – 4 l/soat; yuborilayotgan suvli eritmani purkash forsunkasiga bosimi 0,2 MPa.

Olingan 1-4 namunadagi quruq ekstraktlar bo‘lakchalar ko‘rinishida bo‘lganligi sababli pichoqli tegirmonda maydalandi va teshiklari diametrining o‘lchami 0,5 mm bo‘lgan elakdan o‘tkazildi.

Keltirilgan ma’lumotlardan shuni kuzatish mumkinki purkab quritish turida olib borilgan quritish jarayoniga boshqa ko‘rilgan turlarga nisbatan eng kam vaqt sarflangan. 1-4 usullarda to‘q jigarrang va qo‘ng‘ir rangli zarrachalardan iborat bir hil ko‘rinishga ega bo‘lmagan kukunsimon ko‘rinishidagi quruq ekstraktlar olindi. 5-usulda esa bir hil ko‘rinishga ega bo‘lgan och jigarrang kukunsimon ko‘rinishidagi quruq ekstrakt olindi. Bundan tashqari 1-4 usullarda olingan quruq ekstraktlar keyingi bosqichda maydalash va elash jarayonidan o‘tiladi. Bu bosqichlarda quruq ekstraktlarning ma’lum bir qismi yo‘qotilishiga olib keldi, jumladan, 3-4 marta qayta maydalashda ham 10-12 % quruq ekstraktlarni elakdan o‘tkazishni iloji bo‘lmadi. 2 va 4 usulda esa quruq ekstraktlar qisman g‘ovvaksimon bo‘lakchalarga ega bo‘lganligi uchun ularni maydalash osonroq kechdi. Lekin bu borada 5-usul yana boshqalariga nisbatan ustun, chunki jarayon so‘ngida mayda zarrachali kukunsimon quruq ekstrakt olinadi va maydalash, elash kabi jarayonlar zarur bo‘lmaydi. 5-usulda olingan quruq ekstraktning namlik ulushi boshqa ko‘rilgan turga nisbatan kamligi, mazkur turning yana bir ustunligi hisoblanadi.

Yuqoridagilardan kelib chiqib, dag‘al dalachoy quruq ekstraktini olishda purkab

quritish qurilmasidan foydalanish afzal deb topildi.

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