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| **Table S1**. **Known phenolic small molecules and polymers of chaga and their purification/identification** | | | | | | |
| **Phenolics** | **Molecular formula** | **Extraction Method** | **Qualification Method** | **Purification Method** | **Production regions** | **Reference** |
| Gallic acid | C7H6O5 | Water or 70% ethanol, 70-80℃, 2-24 h | LC | - | Mycelia Culture;  Chaga from Russia, Canada | Zheng et al. (2008);  Glamočlija et al. (2015)  Abu-Reidah et al. (2021) |
| Protocatechuic acid | C7H6O4 | Water or 70% ethanol, 70-80℃, 2-24 h/Water boiling, 1 h | LC, LC-MS and GC-MS, MS and 1H-NMR/13C-NMR | Liquid-liquid extraction, HP-20 column and HPLC (C18 column) | South Korea, Russia, Finland, Thailand, Canada | Ju et al. (2010); Nakajima et al. (2007); Glamočlija et al. (2015); Abu-Reidah et al. (2021) |
| *p*-Hydroxybenzoic acid | C7H6O3 | Water or 70% ethanol, 70-80℃, 2-24 h | LC | - | Finland, Thailand, Canada | Glamočlija et al. (2015) |
| Vanillic acid | C8H8O4 | High-pressure steam, 35% methanol, 35% acetone, 30% water | LC-MS and GC-MS | Liquid-liquid extraction | South Korea, Russia | Ju et al. (2010)  (Chang et al., 2022) |
| 2,5-Dihydroxyterephthalic acid | C8H6O6 | High-pressure steam, 35% methanol, 35% acetone, 30% water or Water boiling, 1 h | LC-MS and GC-MS, MS and 1H-NMR/13C-NMR | Liquid-liquid extraction or/and HP-20 column and HPLC (C18 column) | South Korea, Russia, Canada | Nakajima et al. (2009); Nakajima et al. (2007); Ju et al. (2010);(Abu-Reidah et al., 2021) |
| Caffeic acid | C9H8O4 | Water boiling, 1 h | MS and 1H-NMR/13C-NMR | Liquid-liquid extraction, HP-20 column and HPLC (C18 column) | Russia | Nakajima et al. (2007) |
| 3,4-Dihydroxybenzalacetone | C10H10O3 | Methanol, six times or water boiling, 1 h | MS and 1H-NMR/13C-NMR | Liquid-liquid extraction, HP-20 column and HPLC (C18 column) or Sephadex LH-20 column/silica gel column | America, Russia | Kim et al. (2011);  Nakajima et al. (2007) |
| 3,4-Dihydroxybenzaldehyde | C7H6O3 | Methanol, two times, room temperature | IR spectra, MS and 1H-NMR/13C-NMR | Liquid-liquid extraction, HP-20 column and HPLC (C18 column) | Russia, China | Nakajima et al. (2007); Liu et al. (2014) |
| 6,7-Dihydroxycoumarin | C9H6O4 | High-pressure steam, 35% methanol, 35% acetone, 30% water | GC-MS | Liquid-liquid extraction | South Korea | Ju et al. (2010) |
| 4-Hydroxy-3,5-dimethoxy benzoic acid 2-hydroxy-1-(hydroxymethyl) ethyl ester | C12H16O7 | Water boiling, 1 h | MS and 1H-NMR/13C-NMR | Liquid-liquid extraction, HP-20 column and HPLC (C18 column) | Russia | Nakajima et al. (2007) |
| 2,5-Dihydroxybenzaldehyde | C7H6O3 | Methanol, six times | MS and 1H-NMR/13C-NMR | Liquid-liquid extraction, silica gel column, MPLC, HPLC/ Sephadex LH-20 column | America | Kim et al. (2011) |
| Inonoblin A/phelligridin I 624 | C33H20O13 | Methanol, two times, RT | MS and 1H-NMR/13C-NMR | Liquid-liquid extraction, Sephadex gel LH-20 column | Unknown | Lee et al. (2007) |
| Inonoblin B 450 | C23H14O10 |
| Inonoblin C 461 | C25H18O9 |
| Phelligridin D 380 | C20H12O8 |
| Phelligridin E 474 | C25H14O10 |
| Phelligridin G 594 | C32H18O12 |
| Methylinoscavin A 476 | C26H20O9 | Petroleum ether, chloroform, ethyl acetate, acetone, ethanol and water, reflux for three times | 1H-NMR | - | China | Zheng et al. (2011) |
| Methylinoscavin B 450 | C25H22O8 |
| Methylinoscavin C 434 | C24H18O8 |
| Phelligridin C 364 | C20H12O7 |
| Phelligridin H 622 | C33H18O13 |
| Phelligridin F 478 | C26H22O9 |
| 2,3-Dihydroxy-1-(4-hydroxy-3-methoxyphenyl)propan-1-one | C10H12O5 | 95% Ethanol, 2 h, reflux, three times | IR spectra, MS and 1H-NMR/13C-NMR | Liquid-liquid extraction, silica gel column, Sephadex gel LH-20 and HPLC (C18 column) | China | Liu et al. (2014) |
| 2,3-Dihydroxy-1-(4-hydroxy-3,5-dimethoxyphenyl)-1-propanone | C11H14O6 |
| 4-(3,4-Dihydroxyphenyl)-(E)-3-buten-2-one | C11H14O6 |
| Davallialactone | C25H20O9 | - | LC and 1H-NMR/13C-NMR | - | Mycelia culture | Zhao et al. (2015b) |
| Methyl davallialactone | C26H22O9 |
| Inoscavin C 420 | C23H16O8 |
| p-Coumaric acid | C9H8O3 | 70% Aqueous acetone, 24 h, RT, three times | LC | - | Mycelia culture | Zheng et al. (2009) |
| Rhoifolin/apigenin-7-O-neohesperidoside | C27H30O14 |
| Isorhoifolin/apigenin-7-O-rutinoside | C27H30O14 |
| Naringin/naringenin-7-O-neohesperidoside | C27H32O14 |
| Isorhamnetin-3-O-rutinoside | C28H32O16 |
| Rutin | C27H30O16 |
| Narirutin | C27H32O14 |
| Kaempferol | C15H10O6 |
| Quercetin | C15H10O7 |
| Isohamnetin | C16H12O7 |
| Luteolin | C15H10O6 |
| Naringenin | C15H12O5 |
| Apigenin | C15H10O5 |
| Fortuneletin/5,7-dihydroxy-3'-methoxyflavone | C16H12O5 |
| EGCG | C22H18O11 |
| ECG | C22H18O10 |
| Inoscavin B | C24H20O8 |
| Myricetin | C15H10O8 | Water (pH = 2.5, 7.0, 9.5, and 11.5), accelerated solvent extraction (number of cycles = 2; pressure = 1500 psi; static time = 5 min; flush ratio = 50% rinse, and temperature = 60 °C and 100 °C) | UPLC-MS and UPLC-HRAM-MS/MS | Polar acclaim C18 column and Luna C18 column | Newfoundland, Canada | Abu-Reidah et al. (2021) |
| Protocatechuic acid glucoside | C13H16O9 |
| Methylellagic acid | C16H10O8 |
| Hispolon | C12H12O4 |
| Ellagic acid | C14H6O8 |
| Methoxycinnamic acid | C10H10O3 |
| Hispidin | C13H10O5 |
| Salicylic acid | C7H6O3 |
| Dihydroxybenzaldehyde | C7H6O3 |
| Alpha-Tocopherols | C29H50O2 |
| Beta-Tocopherols | C28H48O2 |
| Delta-Tocopherols | C27H46O2 |
| Phellxinye A | C30H20O16 | 70% ethyl alcohol (EtOH), for 2 h at 70 °C for three times | LC, MS, ECD, MS, 1H-NMR/13C-NMR | Liquid-liquid extraction, silica gel and octadecylsilyl silica gel column, semipreparative HPLC (YMC C18 column), HP-20 macroporous resin | Russia | (Chang et al., 2022) |
| Inonotphenol A | C12H10O6 |
| Erythro-4,7,9,9′-tetrahydroxy-3,5,3′,5′-tetramethoxy-8-O-4′- neolignan | C22H28O10 |
| (9S)-acerogenin M | C19H20O4 |
| (− )-(S)-acerogenin B | C19H22O3 |
| 4-hydroxybenzalacetone | C10H10O2 |
| 4-Methoxyisophthalic acid | C9H8O5 |
| 2-Hydroxy-3-methoxy-5-(3-oxo-1-buten-1-yl)benzoic acid |  |
| sinapaldehyde | C11H12O4 |
| tri-O-methylgallate | C11H14O5 |
| Homogentisic acid | C8H8O4 | HCl-acetonitrile, 2 h, RT | LC | - | Russia | Kim et al. (2008) |
| Ferulic acid | C10H10O4 |
| *o*-Coumaric acid | C9H8O3 |
| Resveratrol | C14H12O3 |
| 2,6-Dimethoxyphenol | C8H10O3 | HCl-water, 5 h, reflux; then hot ethyl acetate and methanol | IR spectra and GC-MS | - | Poland | Mazurkiewicz (2006) |
| Resorcinol | C6H6O2 |
| 3-Hydroxy-4,5-dimethoxybenzoic acid | C9H10O5 |
| 3-Hydroxy-2-oxo-2Hchromene-4,6-dicarboxylic acid | C11H6O7 | 70% Methanol, 12 h, 60°C | IR spectra, MS, UV and 1H-NMR/13C-NMR | Liquid-liquid extraction, silica gel column, Sephadex gel LH-20/ ODS-Sepak cartridge and HPLC (C18 column) | South Korea | Hwang et al. (2016) |
| 6,6'-Dihydroxy- (1,1′-biphenyl)-3,3′-dicarboxylic acid | C14H10O6 |
| 4-Hydroxy-3,5-dimethoxybenzoic acid/syringic acid | C9H10O5 |
| 4-Hydroxyisophthalic acid | C8H6O5 |
| Eriocitrin | C27H32O15 | 50% Methanol, 24 h, RT | LC | - | Mycelia culture | Zheng et al. (2008) |
| Isorhamnetin | C16H12O7 |
| EGC | C15H14O7 |
| 2,3-Dihydroxybenzaldehyde | C7H6O3 |
| (2‘R)4-[1-(Hydroxymethyl)-2-methoxy-2-oxoethoxy]-3,5- dimethoxy benzoic acid methyl ester | C14H18O8 | - | MS and 1H-NMR/13C-NMR | Chiralpak IG column | Unknown | Zou et al. (2019) |
| (2‘S)4-[1-(Hydroxymethyl)-2-methoxy-2-oxoethoxy]-3,5- dimethoxy benzoic acid methyl ester | C14H18O8 |
| 4-Hydroxy-3,5-dimethoxy-2-butoxy-2- oxoethyl ester | C15H20O7 |
| Lignin-carbohydrate complexes (37.9 and 24.5 kDa, 75-80% lignin) | - | Water, 4 h, 60°C | HPSEC | Anion-exchange chromatography (DEAE-cellulose column); SEC (Sephadex G-25 column); dialysis | China | Wang et al. (2015) |
| Lignin-carbohydrate complexes (29, 35, and 61 kDa, 64% lignin) | - | NaOH-water, 12 h, 4°C | HPSEC | Anion-exchange chromatography (DEAE-cellulose column); SEC (Sephadex G-25 column); dialysis | China | Niu et al. (2016) |
| RT: room temperature; SEC: size exclusion chromatography; HPSEC: high performance size exclusion chromatography | | | | | | |

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