Activity-guided identification of (S)-malic acid 1-O-D-glucopyranoside (morelid) and gamma-aminobutyric acid as contributors to umami taste and mouth-drying oral sensation of morel mushrooms (Morchella deliciosa Fr.)

Although morel mushrooms are widely used as tasty ingredients in savory dishes, knowledge of the key compounds evoking their attractive taste is still very fragmentary. In the present study, taste activity-guided fractionation of an aqueous morel extract by means of the recently developed taste dilution analysis (TDA) enabled the localization of several umami-like-tasting fractions as well as a fraction imparting an intense mouth-drying sensation to the oral cavity. Hydrophilic interaction liquid chromatography (HILIC), LC-MS, and amino acid analysis led to the successful identification of gamma-aminobutyric acid as the chemical inducer of the mouth-drying and mouth-coating oral sensations imparted by the morel extract. Besides the well-known umami-like taste contributors L-glutamic acid, L-aspartic acid, and succinic acid, an additional HILIC fraction was isolated and evaluated as tasting umami-like. LC-MS and NMR studies revealed that this fraction consisted of a mixture of (S)-malic acid 1-O-alpha-D-glucopyranoside and (S)-malic acid 1-O-beta-D-glucopyranoside, the structure of which could be successfully confirmed by independent synthesis. To the best of our knowledge, this morel-derived glycoside, which we named
(S)-morelaid, has previously not been reported in any food products. Sensory analysis of aqueous solutions of the compounds identified revealed threshold concentrations of 0.02 mmol/L for the mouth-drying effect of gamma-aminobutyric acid and 6.0 mmol/L for the umami-like, slightly sour taste of (S)-morelaid.