Evaluation of the Bitter Taste in Virgin Olive Oil

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An analytical method has been developed to evaluate the intensity of the bitter taste in virgin olive oil. Results from the proposed method, based on extraction of the bitter constituents of virgin olive oil with methanol/water and measurement of the absorbance at 225 nm, show a significant correlation with the intensity of bitterness that had been evaluated in a sensorial manner by a panel. The developed method, therefore, offers a real alternative to the panel test for the evaluation of this attribute.

KEY WORDS: Bitter taste, virgin olive oil.

Bitter taste is one of the characteristic attributes of virgin olive oil (1,2). Its intensity varies greatly and influences consumer attraction and acceptance. Thus, although a low intensity is pleasant, a high one lessens the organoleptic characteristics of the oils and, consequently, their quality. This makes consumer rejection possible, causing commercial problems.

Presently evaluation of the bitter taste in virgin olive oils can only be made in a sensorial manner (panel test) or by HPLC (high-performance liquid chromatography) analysis of an oil extract and quantifying four of its components, as these correlate well with the intensity of bitterness determined sensorially (3). Interest in the topic has led us to develop a quicker and easier technique; and the results are presented in this work.

MATERIALS AND METHODS

Analysis was carried out on 75 samples of virgin olive oil. Octadecyl (C_{18}) disposable extraction columns (6 mL) from J.T. Baker Chemical Company (Phillipsburg, NJ) were used. For the extraction procedure of the bitter components, a sample of 1.0 ± 0.01 g virgin olive oil was dissolved in 4 mL hexane and passed over the C_{18} column [previously activated with methanol (6 mL) and washed with hexane (6 mL)]. After elution, 10 mL hexane was passed to eliminate the fat, and then the retained compounds were eluted with methanol/water (1:1) to 25 mL in a tared beaker. The absorbance of the extract was measured at 225 nm against methanol/water (1:1) in a 1-cm cubette. The intensity of bitterness (IB) of the oil samples was evaluated by the panel of the Instituto de la Grasa. This panel was formed by 12 tasters, and a five-point scale was used (3). The statistical analysis was carried out with a Model II regression analysis by the three-group method of Bartlett (4), and correlation analysis.

RESULTS AND DISCUSSION

The preliminary tests referred to above showed that the bitter components are extracted from the oil and recovered completely upon elution with MeOH-H_2O, because the final aqueous phase gives the initial bitter taste and it is completely lacking in the oil.

TABLE 1

Absorbance Data at 225 nm and Taste Panel Scores for 75 Virgin Oil Samples to Evaluate Degree of Bitterness

Samples	K_{222}	IB	Samples	K_{222}	IB	Samples	K_{222}	IB
1	0.322	3.3	26	0.237	2.4	51	0.132	1.6
2	0.351	3.5	27	0.205	1.6	52	0.187	2.0
3	0.217	2.3	28	0.172	1.1	53	0.149	1.0
4	0.321	3.1	29	0.208	2.6	54	0.236	2.2
5	0.109	0.9	30	0.189	0.8	55	0.161	1.2
6	0.330	3.5	31	0.159	0.8	56	0.347	3.1
7	0.203	1.9	32	0.213	2.2	57	0.304	3.6
8	0.189	1.9	33	0.181	0.9	58	0.222	1.9
9	0.119	1.1	34	0.022	0	59	0.266	2.9
10	0.231	2.5	35	0.159	1.0	60	0.218	2.8
11	0.135	0.9	36	0.127	0.8	61	0.201	2.6
12	0.277	2.6	37	0.155	1.3	62	0.138	1.5
13	0.217	1.9	38	0.244	2.6	63	0.291	3.0
14	0.219	1.4	39	0.203	2.0	64	0.295	3.2
15	0.084	0.4	40	0.246	2.5	65	0.102	1.3
16	0.348	3.6	41	0.209	2.3	66	0.086	0.6
17	0.180	1.3	42	0.292	2.7	67	0.298	2.9
18	0.193	1.5	43	0.224	2.4	68	0.280	2.9
19	0.151	1.1	44	0.282	2.7	69	0.168	1.7
20	0.046	0	45	0.265	2.4	70	0.119	0.9
21	0.239	2.6	46	0.227	2.3	71	0.308	3.2
22	0.454	3.9	47	0.199	2.0	72	0.326	3.6
23	0.287	2.4	48	0.165	1.2	73	0.298	3.3
24	0.182	1.4	49	0.208	2.2	74	0.068	0.4
25	0.274	2.7	50	0.275	2.8	75	0.076	0.5

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The absorbance spectrum of the extract presents two maxima at 225 nm and 278 nm, respectively. The former best defines the difference, and thus the 225 nm wavelength has been chosen in this study. The results are expressed as the absorbance of 1 g in 100 (K_{225}). Table 1 shows the K_{225} values and the intensity of bitterness for the 75 samples studied. The correlation coefficient obtained is $r = 0.914$, which is extremely significant for 73 degrees of freedom: $r(0.001, 73) = 0.380$.

Given an experimental value of K_{225}, the intensity of bitterness that might be expected from a taste panel is calculated from the following expression: $IB = 13.33\ K_{225} - 0.837$.

From the results of this work, it is deduced that K_{225} of the order of 0.140 or less correspond to oils with intensity of bitterness 1 or less, *i.e.*, to non-bitter or almost imperceptibly bitter oils. As has been stated, when the intensity of bitterness increases, problems can arise for the oil's direct consumption. Although there is no clear or established limit, experience has shown that such problems begin to appear when the intensity exceeds 2.5, corresponding to a K_{225} value of 0.250, which can serve as an obvious reference point. K_{225} values of the order of 0.360 or higher correspond to quite bitter oils (high or extremely high intensities), which are rejected by many consumers.

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