

The Committee upon Food Standards of the United States (Circ. 19, Department of Agriculture, Washington, June, 1906) recommends the following standards for Cloves:—

'The dried flower buds of *Caryophyllus Aromaticus*, which contain not more than 5 per cent of clove stems; not less than 10 per cent Volatile Ether Extract; not less than 12 per cent quercitannic acid; not more than 8 per cent total ash; not more than 0.5 per cent ash insoluble in hydrochloric acid; not more than 10 per cent crude fibre.'

The volatile Ether Extract mentioned in this definition is not strictly identical with volatile oil, for the reason that it is determined on the cloves after drying by a method which involves a considerable, and an unknown loss of volatile oil. The limit of 10 per cent for volatile Ether Extract named in the United States definition is certainly too low to apply to volatile oil.

In July and August of 1907, a collection of 145 samples of ground Cloves was made and is reported in Bulletin 173. It was found possible to classify only 52 per cent of this collection as undoubtedly genuine. On the other hand, the absence of legally established limits made it impossible to declare adulteration except in cases where foreign matters were present.

Although the work reported in Bulletins 73 and 173 furnishes material for a tentative scheme of assaying cloves, it was felt that some points needed further elucidation, and the present report is the result. The following conclusions seem to be justified as a study of the whole:—

1. The total ash of cloves, free from stems should not exceed 6 per cent.
2. Presence of stems considerably increases the Ash.
3. Ash insoluble in hydrochloric acid is very low in clove buds, not exceeding two or three-tenths of one per cent.
4. Addition of stems notably increases the acid-insoluble Ash.
5. The volatile oil of cloves is the most important character, and is at the same time the component which gives the spice its value as a condiment. Determination of volatile oil is complicated by the fact that any moisture (normally 6-7 p.c.) comes off with the oil; and attempts to dry the clove, necessarily result in loss of volatile oil.
6. The best way of drying cloves would appear to be the use of sulphuric acid in vacuo. The point at which the oil comes off in notable amount being indicated by discolouration of the acid.
7. The volatile oil of cloves should not be less than 14 per cent by weight of the cloves, and may reach 19 per cent.
8. The total volatile matter of cloves, consisting of water and volatile oil should not be less than 16 per cent, and may reach 25 per cent of the weight of the cloves.
9. The fixed oil of cloves, determined by extraction on the properly prepared sample should be about 10 per cent of the weight of the cloves, when estimated by loss. This component seems to be more variable than the others, and to be less affected by the commercial treatment of the clove for Eugenol.

On account of their high content in oil, manufacturers find it difficult (some say impossible) to grind cloves without addition of something to take up the excess of oil. For this purpose, Pimento (all-spice) seems the most in use; but clove-stems, and possibly certain starches, may be employed. The use of pimento, or other suitable matter, for such purpose does not constitute adulteration, provided that the article be sold as a compound or mixture. (R.S. 1906, Chap. 133, Sec. 24a).

Over one hundred samples of the present collection contain pimento, in amounts varying from a small percentage to apparently 30 or 40 per cent of the sample. This consideration with the fact that the cost of pimento is only about one-half the cost of the cloves, makes it evident that not only must the fact of admixture be

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