

concentrations are shown in Figure 4, with the I_{50} value determined to be 2×10^{-6} M. This value agrees well with the I_{50} values determined manually by Findak (1979). This value also agrees well with I_{50} value determined by Magee and Limpel (1977) and Chin et al. (1974), who used bovine erythrocyte cholinesterase as the enzyme source.

Within-Run and Day-to-Day Precision. The results of the within-run and between-run (day-to-day) precision checks are shown in Table I. The within-run CV ranged between 5.9 and 9.0%, while the between-run CV ranged from 3.7 to 7.9%.

The preceding data demonstrate the establishment of a reliable and reproducible automated method for cholinesterase I_{50} values. In addition to these advantages, high rate of throughput (400 samples/h) and low reagent cost are typical advantages for the centrifugal analyzer method. Therefore, this method can be used to facilitate compound development and provide for more thorough structure-activity relationship studies.

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On the Odor of 2-Methylisoborneol

Sir: In a recent paper in this journal, Tyler et al. (1978) described the odor of both enantiomers of 2-methylisoborneol (1,2,7,7-tetramethyl-*exo*-bicyclo[2.2.1]heptan-2-ol and 1,2,7,7-tetramethyl-*endo*-bicyclo[2.2.1]heptan-2-ol) as camphoraceous rather than earthy. A similar characterization was earlier reported by Gerber (1969). Since several studies mentioned by Tyler et al. (1978) indicate 2-methylisoborneol as an agent responsible for a musty or earthy odor in water or garden soil (Buttery and Garibaldi, 1976; Collins et al., 1970; Medsker et al., 1969; Wood and Snoeyink, 1977), an additional note on this seeming discrepancy is warranted.

A well-known phenomenon, although generally anecdotically reported, is that the odor character of a chemical compound may depend on the concentration of the compound (Polak et al., 1978). This is also the case for 2-methylisoborneol. Persson and York (1978), working with synthetic (-)-2-methylisoborneol, reported that the pure compound exhibited a camphoraceous odor, but that solutions of 0.01-10.0 μg of 2-methylisoborneol/L of water (twice distilled) exhibited a musty or muddy odor. Many judges considered aqueous solutions of 100 μg of 2-methylisoborneol/L as clearly camphoraceous, some considered solutions of 10.0 μg /L as camphorlike, and a few even characterized the odor of 1.0 μg of 2-methylisoborneol/L of water as camphoraceous (Persson and York, 1978; Persson, 1979). On consideration of these facts, the odor characterization delivered by Tyler et al. (1978) fits well into the picture, since they worked on the pure compounds and solutions of 1 ppt and 1 ppm in water.

It should be noted that Wood and Snoeyink (1977) worked on solutions containing 0.1-10.0 μg of 2-methylisoborneol/L and described these as earthy/musty. Medsker et al. (1969) described the odor of 2-methylisoborneol as camphoraceous, but indicated that the compound may be responsible for an earthy or musty taint in water. Zoeteman and Piet (1973), working with a large

consumer panel (708 participants) in the Netherlands, described the odor of a solution of 0.12 μg of methylisoborneol/L of water as clearly earthy ("bosgrond" = woodland; "aarde" = earth, mold).

Thus, it appears that the discrepancy in the odor characterization of 2-methylisoborneol is to some extent due to work on different concentrations of the compound, although it is evident that experimental conditions have varied in other respects, too. Nevertheless, the conclusion implied by Tyler et al. (1978) that (-)-2-methylisoborneol does not exhibit a musty odor is premature; i.e., it is true for concentrated solutions of the compound. It may be concluded that odor characterization of compounds in the pure state may not be relevant for situations where these compounds appear as trace contaminants, exhibiting different odor characteristics, as is the case for 2-methylisoborneol in natural waters.

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