

Figure 1—Rate of clearance of ^{99m}Tc -labeled polystyrene beads bearing triethylenetetramine functions from the stomach of a normal human male subject (half-time of gastric emptying = 51 min).

these subjects exhibited longer gastric emptying times (115 min) (Fig. 2).

Measurement of gastric emptying is an important aid to the clinician studying gastroduodenal disease, dumping syndrome, and postvagotomy disturbances. Gastric emptying is delayed in malignant disease of the stomach, gastric ulcers, and pyloric stenosis. On the other hand, hastened emptying has been associated with duodenal ulcers. Symptoms of dumping syndrome and diarrhea following gastrectomy and vagotomy are due to altered gastric emptying (10). A simple, accurate, and noninvasive technique for measuring gastric emptying is needed. ^{99m}Tc-Labeled I has a great potential for becoming a popular radiodiagnostic agent for routine clinical determinations of gastric emptying times.

Gastric emptying has been suggested to be a major determinant in the absorption rate of drugs. Individual



Figure 2—Rate of clearance of 9^{99m} Tc-labeled polystyrene beads bearing triethylenetetramine functions from the stomach of a female patient with pyloric stenosis (half-time of gastric emptying = 115 min).

variations in the rate of drug absorption from any one dosage form may be due largely to differences in the rate of gastric emptying (13, 14). Experiments are now in progress to assess ^{99m}Tc-labeled I in studying the effects of drugs on the gastric emptying rate as well as the gastric emptying influence on drug bioavailability.

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Identification of an Impurity in Illicit Amphetamine Tablets

Keyphrases \Box Amphetamine—illicit tablets, impurity identified as α -benzylphenethylamine $\Box \alpha$ -Benzylphenethylamine—identified as impurity in illicit amphetamine tablets \Box Contaminants— α -benzylphenethylamine identified in illicit amphetamine tablets

To the Editor:

An impurity detected in exhibits of illicit amphetamine tablets has been identified as α -benzylphenethylamine (I). The tablets, of a type known as "mini-bennies," were found to contain caffeine as well as *dl*-amphetamine (II), the latter as a sulfate salt. TLC examination on silica gel plates¹ revealed an additional spot, R_f 0.7, which, upon

¹ Mobile phase consisted of ammonia-saturated chloroform-methanol (18:1); visualization was by shortwave UV.

 $C_6H_5CH_2COCH_3 \rightarrow C_6H_5CH_2CH(CH_3)NHCHO \rightarrow$

IV

Scheme I

III

extraction with chloroform and subsequent conversion to the hydrochloride salt, produced an IR spectrum somewhat similar to that of II hydrochloride. The pattern at 2300–2700 cm⁻¹ was typical of primary amine salts; strong, sharp bands at 703 and 754 $\rm cm^{-1}$ were indicative of monosubstituted phenyl; intense bands appearing at 1452, 1491, and 1599 cm^{-1} were attributed to phenyl and methylene absorption.

The mass spectrum of I² exhibited a base peak at m/e120 with further fragmentation indicative of benzyl (m/e)91, 77, 65, 51, and 39). Additional intense ions appeared at m/e 103 and 42. Considering that amines generally produce their most intense peaks by β -fission or α,β' -fission with hydrogen rearrangement (1), it was felt that the amino group was attached to a carbon atom with two substituents. The absence of any significant fragmentation above m/e 120 ruled out additional substitution. The possibility of a single α -substituent was eliminated by the absence of an intense m/e 30 fragment. From the foregoing considerations, the structure of I was deduced.

Support for the proposed structure was obtained from the NMR spectrum³ of the salt (deuterium oxide), which displayed the following features: singlet at 7.37 ppm⁴ (phenyl), multiplet at 3.0-4.0 ppm (methine), and a pair of doublets at 3.00 and 3.02 ppm (nonequivalent methylene hydrogens). Integration indicated a ratio of two phenyl and two methylene groups to one methine.

For verification of the assigned structure, a hydrochloride salt, mp 202-202.5° [lit. (2-5) mp 200-205°], was prepared from a known material⁵; IR and NMR spectra were identical to those prepared from extracts of the unknown substance.

The origin of I as a contaminant has been postulated as follows.

The presence of traces of N-formylamphetamine (III)

From sodium 3-trimethylsilylpropionate-2,2,3,3-d4.

⁵ ICN Pharmaceuticals, Plainview, N.J

$(C_6H_5CH_2)_2CO \rightarrow (C_6H_5CH_2)_2CHNHCHO \rightarrow (C_6H_5CH_2)_2CHNH_2$ VI v I Scheme II

in the tablet extracts, as determined by GLC-mass spectrometry (6), indicated that II was prepared by some form of the Leuckart synthesis, in which methyl benzyl ketone (IV) reacted with ammonium formate or formamide (7, 8), producing III as an intermediate. Subsequent hydrolysis converted it to II (Scheme I).

Dibenzyl ketone (V), a by-product in the Aonuma et al. (9) synthesis of IV, was found as a contaminant accompanying IV in illicit preparations of amphetamine-type drugs (6). It has already been reported to produce I via Leuckart procedures (2, 10; Scheme II); hence, its presence as an impurity in IV is a likely cause for the accompaniment of II by I.

The appearance of I as an amphetamine contaminant poses serious implications due to its reported toxicity (11, 12).

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² Finnigan model 3100D quadrupole El-MS. ³ Jeol C-60HL.