

APPARATUS FOR HOMOGENIZING AND HANDLING BIOWASTE AND OTHER MATERIALS IN ISOLATION

FIELD OF THE INVENTION

This invention relates to apparatus and a method for receiving a chemical sample that is either inherently obnoxious, such as fecal matter, or for other reasons is hazardous or difficult to homogenize prior to its analysis. In particular, the invention relates to apparatus for receiving such samples in a restricted chamber, homogenizing the samples with a suitable liquid, and withdrawing measured aliquots of the homogenized material into closed individual containers containing, if necessary, suitable reagents for further analysis.

BACKGROUND OF THE INVENTION

No one who has lived through the experience will question the fact that the analysis of fecal samples is one of the most unpleasant tasks performed in a medical diagnostic laboratory. The offensive nature of the sample, combined with the inadequacy of the sampling techniques and methods available—none of which has been specifically designed to deal with fecal matter—have resulted in considerable neglect of this important area of clinical analysis.

Chapter 107 of Gradwohl's *Clinical Laboratory Methods and Diagnosis*, 7th ed., 1970, (one of the standard reference books) relates to the analysis of fecal samples and starts out as follows: "The examination of the feces, although generally stressed by clinical teachers as an important means of diagnosis in medical and surgical cases, is seldom thoroughly performed. . . most physicians are not adequately utilizing this type of examination". It then goes on to say: "The indifference to the possibilities of help from routine stool examinations, lack of concise information as to technique and interpretation, and esthetic objection to handling the material, all have contributed to this field of laboratory work being neglected by most workers and students. . . we believe much more emphasis must be placed on this subject".

The development of a suitable automatic apparatus for the collection, homogenization and sampling of feces would remove the esthetic objections alluded to above and permit the performance of a number of tests of obvious diagnostic and/or prognostic value. Besides, the determinations would be made quantitative (rather than qualitative or semi-quantitative as they are now) and readily automatable using autoanalyzers already in existence.

Examples of clinically important determinations that would be greatly facilitated are:

(1) Quantitative (24 hour) determination of electrolyte losses in feces. Included here are such ion as Na^+K^+ , Mg^{++} , Ca^{++} , P, and Cl^- . A better knowledge of the amount of fecal electrolyte losses can contribute greatly to the proper management of patients with acute or chronic diarrhea.

(2) Quantitative determination of fecal fat. This seldom-utilized procedure tests the ability of the gastrointestinal track to digest and absorb the fat contained in a test meal. It reflects pancreatic function as well as intestinal function. The use of radioactively labeled fats added to the test meal greatly simplifies the methodology required.

(3) Tests of intestinal absorption. One example is the determination of nitrogen content as a measure of digestion and absorption of protein. Fecal nitrogens are an essential part of nitrogen balance studies.

(4) Quantitative determination of blood losses.

(5) Determination of fecal pH.

(6) Coprocultures. There is much to be gained by the study of the "normal" flora of the intestine and its variations in response to alterations in diet composition, orally administered drugs, etc.

(7) Determination of fiber content of the feces. This is receiving increasing attention lately since it relates to the pathogenesis of syndromes as common as constipation and diverticulosis as well as carcinoma of the colon which is now the second most common cause of cancer-related deaths among American males.

(8) Quantitative determination of fecal sterols. The fecal route is the most important one for the elimination of cholesterol and its derivatives (bile acids and breakdown products thereof), and improved testing has obvious significance in the management of patients with coronary heart disease.

(9) Determination of enzyme activities in feces. Two kinds of enzymatic activities are of interest: one is the group of digestive enzymes that have been measured in feces for quite some time and are of value as tests of pancreatic and intestinal function. The other kind is non-digestive enzymes not normally present in feces but which would appear as a consequence of cell-rupture of the intestinal lining—whatever the cause. It is anticipated that these assays should provide good indicators of the presence and extent of inflammatory disease of the G.I. tract. The determination of enzymes of bacterial origin is being actively developed and promises to become a valuable tool in determining the presence of microorganisms difficult to cultivate.

(10) Presence of carcinogens and/or other hazardous compounds. Carcinogens derived from tobacco smoke are swallowed and must eventually appear in feces unless absorbed or degraded in transit. Similarly a number of other hazardous materials contaminating the intestinal environment (industrial air and water pollutants, by-products of the metabolism of intestinal microflora, etc.) should be detectable in feces presumably before permanent damage is inflicted.

There are many other analyses that should be possible if suitable apparatus were available to receive and handle the samples in isolation so as to overcome reluctance by laboratory personnel to carry out existing tests and develop new tests.

OBJECT AND SUMMARY OF THE INVENTION

It is one of the objects of this invention to provide apparatus to receive and to homogenize in a limited environment fecal and other noxious material to be analyzed and means to transfer samples of the homogenized material into closed containers for further analysis.

Another object of the invention is to provide a receptacle for biowaste products and to homogenize them in the receptacle while withdrawing through a separate channel any air that enters the receptacle and is contaminated by odors therein.

A further object is to provide a biowaste receptacle capable of operating as a portable unit to be placed at the bedside of patients in order to receive waste products from such patients without requiring the patient to go to a fixed location, the receptacle being arranged to