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Christian K R & Coup M R. Measurement of feed intake by grazing cattle and sheep. VI. The determination of chromic oxide in faeces.
NZ J. Sci. Technol. A 36:328-30, 1954.

[Ruakura Animal Research Station, Department of Agriculture, Hamilton, New Zealand]

Chromic oxide in ashed faeces samples is dissolved by heating with a mixture of potassium bromate, manganese sulphate, and phosphoric acid. After further bromate oxidation, the chromium is estimated by titration with ferrous ammonium sulphate, using N-phenylanthranilic acid as an internal indicator. [The SCJ® indicates that this paper has been cited in over 125 publications, making it one of the most-cited papers published in this journal.]

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"A common method of measuring total faeces output is to administer a known quantity of an insoluble marker and measure its concentration in the faeces. Although chromic oxide is ideal as a marker in many respects, its analysis is hampered by its refractory nature. Alkali fusion exacts a high toll on crucibles, while perchloric acid oxidation has its problems. A method adapted from the determination of chromium in steels had been in use for some time at Ruakura,¹ involving digestion with a mixture of potassium bromate, manganese sulphate, and sulphuric and phosphoric acids. Its only drawback was that it was rather lengthy, and experimental animals were producing faeces samples nearly as fast as they could be analyzed.

"My first job after graduation was to look for a less time-consuming method. The obvious measures were to increase temperatures and reagent concentrations, but these attempts only led to faster decomposition of

bromate to free bromine. It was not until the day that I tried omitting the sulphuric acid that I managed to get the chromic oxide to dissolve quite rapidly at moderately high temperatures. Even then, the reaction could not be relied upon to go to completion, but some time later, I discovered that manganic ions, formed under these conditions from manganese sulphate, were effective in mopping up any remaining chromic oxide.

"For weeks I tested variations on this theme. I pulled every oxidizing agent I could think of from the shelf. I varied the temperature with sand baths, oil baths, and heating coils. I used test-tubes, basins, and crucibles of different shapes and sizes. These experiments were all kept very simple. I rejected beforehand procedures that called for any degree of skill or carefully controlled conditions, working on the principle that if it was easy enough for me to get the right answers, anybody else could do the same. Moss Coup was most helpful and encouraging, always keen to test out the practicality of the most uncouth modifications. But despite all these inspirations, nothing could improve on the recipe of bromate and manganese in a 150 ml conical flask on a hotplate. All these constituents had been there in the first place; it had been merely a matter of finding the best combination and conditions.

"Once the chromium is in solution, it can be estimated by a variety of methods. I used titration with ferrous ions following complete oxidation, but automated techniques have since been developed.^{2,3}

"I imagine the method has proved popular simply because many workers have used the marker technique⁴ and needed an analytical method that would allow large numbers of samples to be handled simultaneously and give reproducible results without too much difficulty. There is not much to the paper: it is only about twice as long as this article, and the summary runs to 14 words. I doubt that a scientific journal today would accept a contribution such as my first, shortest, and most successful publication."

1. Coup M R & Lancaster R I. The measurement of feed intake by cattle and sheep. II. The determination of chromic oxide and monastral blue in cow faeces. *NZ J. Sci. Technol. A* 34:347-53, 1952.
2. Williams C H, David D J & Iismaa O. The determination of chromic oxide in faeces samples by atomic absorption spectrophotometry. *J. Agr. Sci.* 59:381-5, 1962. (Cited 125 times.)
3. Stevenson A E & Clare N T. Measurement of feed intake by grazing cattle and sheep. IX. Determination of chromic oxide using an AutoAnalyzer. *NZ J. Agr. Res.* 6:121-6, 1963. (Cited 20 times.)
4. Koth A R & Luckey T D. Markers in nutrition. *Nutr. Abstr. Rev.* 42:813-45, 1972. (Cited 60 times.)