A new type of homogeneous oscillating reaction has been observed in the potassium bromate–acetylenedicarboxylic acid–ferroin–sulfuric acid system. This proves that the presence of an "active" methylene group is not a necessary condition for oscillating reactions involving carboxylic acids. Maleic acid can be partly replaced by maleic and fumaric acid in the Belousov reaction. Under the mild experimental conditions of the oscillating reaction, maleic acid undergoes isomerization to fumaric acid.

Two types of homogeneous oscillating reactions are known in aqueous solution. The first is the periodic reaction between iodate and hydrogen peroxide discovered by Bray /1/, the second is the oscillatory oxidation of different organic compounds by bromate in the presence of a catalyst.

Belousov and Zhabotinskii used malonic acid and other dicarboxylic acids as substrates /2, 3/, recently; periodic reactions were reported with acetylacetone and acetone /5, 6/.
We have observed a new type of oscillating reaction. It has been found that the presence of an "active" methylene group or hydroxymethylene group is not a necessary condition for a periodic reaction, because in a sulfuric acid medium acetylenedicarboxylic acid reacts with bromate and ferroin in a periodic manner. According to our experiments, the bromate-acetylenedicarboxylic acid reaction in dilute solutions at room temperature is very slow. One mol of the acid consumes 5–5.4 equivalents of bromate, depending on the experimental conditions. The concentration ranges in which the reaction exhibited oscillating behavior were as follows:

Acetylenedicarboxylic acid: 2–4 \(\times 10^{-1}\) mol dm\(^{-3}\),

Potassium bromate: 4–7 \(\times 10^{-2}\) mol dm\(^{-3}\),

Sulfuric acid: 5 \(\times 10^{-1}\)–1.5 mol dm\(^{-3}\),

Catalyst (ferroin, cerium(III) or manganese(II)): 4.4 \(\times 10^{-4}\) mol dm\(^{-3}\).

The reaction was followed by measuring and recording the redox potential of a bright platinum electrode versus a saturated calomel electrode. The mixture was thermostated at 25°C under nitrogen; the ferroin catalyzed system was studied in detail.

A characteristic feature of this oscillating reaction is that, during the variation of the redox potential, two well-separated phase exhibiting oscillations can be observed, similarly to the system containing acetylacetone /7/. This is illustrated in Fig. 1, from which it is evident that the characteristics of the oscillating reaction (amplitude, frequency, the length of the pre-oscillating period and the non-oscillating interval) are completely different in the two phases, their values depending on the concentration of the reactants, primarily on that of sulfuric acid.