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Note

Response correlation among d.c. and low-frequency a.c. regimes in electron-capture detection*

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A recent study of ours[1] speculatively compared a.c. response in the low-frequency range of an electron-capture detector with d.c. response in the same detector. In particular, response at very low frequencies, *e.g.* around 10 Hz, was thought to arise from the regular-field phase of a.c. ("regular" meaning that the radioactive foil serves as the cathode). Response at higher frequencies, from about 100 to 1000 Hz, was considered to originate from both phases, with the "reversed"-field phase (the foil as the anode) adding to the the roughly constant regular-field contribution.

Based on this model we predicted that, in the very low frequency range, a.c. response should correspond to *one half* of d.c. response. This should be the case at any voltage as long as the d.c. potential and the +/− a.c. rectangular wave amplitude were to be the same. Only the regular-field contribution would be observed, despite

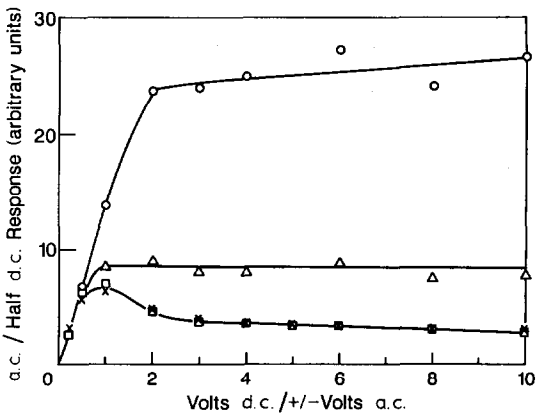

Fig. 1. Response profiles under d.c. and a.c. regimes. Conditions: Varian electron-capture detector, a.c. rectangular wave. ×, d.c. (plotted at half value); □, 4 Hz; △, 100 Hz; ○, 1000 Hz.

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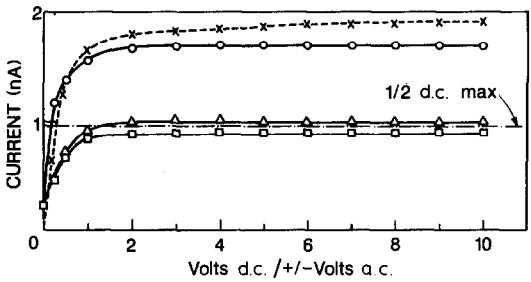

Fig. 2. Current profiles under d.c. and a.c. regimes. Same conditions and symbols as in Fig. 1.

the fact that the electron capture *reaction* is much stronger in the reversed-field than in the regular-field phase.

Owing to the importance that this prediction has for our attempt to interpret the observed behaviour of an electron capture detector driven by an a.c. field, we decided to confirm or deny its validity by direct experiment.

The latter was carried out on a Varian ^{63}Ni electron-capture detector (the detector "A" of our earlier report) under conditions similar in d.c. and a.c., and again with 10 pg lindane as analyte[1].

In Fig. 1, the response at three a.c. frequencies is plotted against *half* the d.c. response. Shown are measurements at 4 Hz (the lowest possible frequency before significant oscillation was registered), 100 Hz and 1000 Hz. Response was also measured at 10 Hz and turned out to be practically identical with the 4 Hz profile of Fig. 1. Fig. 2, for the sake of completeness, provides the corresponding current (baseline) profiles.

These data demonstrate clearly that, in the very low frequency range, a.c. response amounts to half the corresponding d.c. response and, by implication, arises almost completely from the regular-field phase.

ACKNOWLEDGEMENT

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REFERENCE

1 W. A. Aue, K. W. M. Siu and S. S. Berman, *J. Chromatogr.*, 395 (1987) in press.