A Simple Laboratory Setup for Rapid Measurement of β-Ray Dosages above 1 rep/sec[1]

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This apparatus was assembled for the purpose of obtaining absolute dosage measurements on high flux β-ray applicators of the type used in superficial radiation therapy. Ionization current measurements were previously made, using a null method with a Lindemann Electrometer as an indicator. This method was rather time-consuming, taking approximately 6 hr for a complete calibration, whereas the present setup requires about 1 hr for the same measurements, with only a slight decrease in accuracy at levels measured.

The measuring group consists of an extrapolation ionization chamber similar to that devised by Failla (*1*), a micro-microammeter, a regulated power supply, a switching apparatus, and a recording potentiometer.

The ionization chamber (Fig. 1) is a parallel plate type with a movable top plate. The top plate is a disk of 3/16-in. lucite and the bottom plate a disk of 1-in. thick lucite, lucite being chosen because of its similarity to tissue in density and to some extent in electron density. The plates are made conducting by a coating of Alkadag. On the surface of the bottom plate, the collecting electrode is separated from the guard ring by a thin circular scratch made in the Alkadag coating. The collecting electrode is 3.9 mm in diameter as measured by a micrometer microscope. The top plate can be designed for any specific β-applicator, so that the applicator may be set into it above the collecting electrode, thus radiating into the collecting volume through a thin sheet of pliofilm or 1 mm, 2 mm, etc., of lucite. The top plate is fastened to a lucite rim, which is supported by 3 micrometers spaced 120° apart. Adjustment of these micrometers allows the top plate to be moved parallel to the bottom plate through an accurately known distance. Connection is made to the collecting electrode by means of a thin pencil lead running through the bottom plate and terminating in a metal disk on the bottom. A spring-loaded point contact connects this metal disk to an amphenol lead-through type connector.

The ionization current is conducted through RG-58U cable to a Beckmann RGX-2 micro-microammeter. This instrument will measure currents greater than 1×10^{-14} amp. The micro-microammeter is mounted in the same cabinet with a voltage-regulated power supply for the ionization chamber collecting voltage. This power supply embodies a voltage takeoff from an adjustable potentiometer across a VR-150 tube, a polarity reversing switch, and a switch

FIG. 1. Extrapolation ionization chamber.

to ground the output. The micro-microammeter reading is recorded on a 0–10 mv Brown Electronic strip chart recorder.

In making readings, the micrometers are set to zero[2]

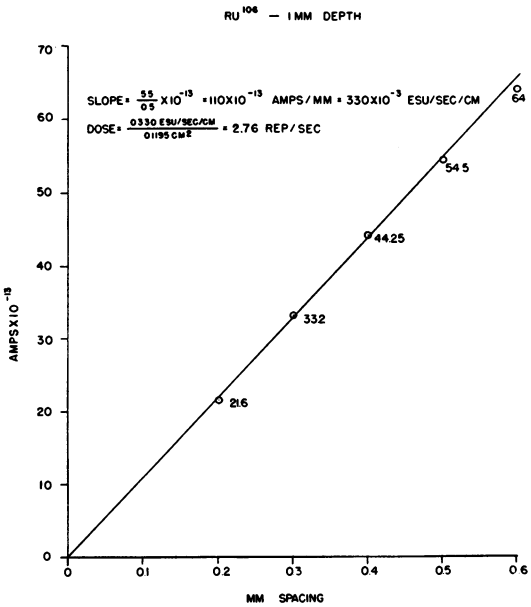

FIG. 2. Sample ionization current vs. plate spacing curve obtained using a Ru^{106} source at 1-mm depth in a lucite phantom. Calculation of radiation dose in rep/sec for this curve is shown.

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[2] Obtaining an exact zero spacing is not important, since the data to be obtained from the measurements are merely the changes in ion currents for known changes in collecting volume in the extrapolation range; that is, the range where the ion current is proportional to the chamber volume. These data are then the slopes of the extrapolation curves.

with the two plates in contact. Spacing can then be adjusted by means of the micrometers to the desired value. Collecting voltage is applied to the top plate, and for plate spacing of .5 mm or less it was found that the knee of the ionization current vs. voltage curve falls somewhat below 10 v and that the plateau extends from this point to over 350 v. In view of this, an operation point of about 40 v was chosen as appropriate for the measurements to be made.

For the dose at any one depth, readings of the ionization current are plotted vs. mm of plate spacing. This curve is essentially a straight line below .5 mm of plate spacing (Fig. 2). The slope of this line can be converted to the units of esu's of charge transferred per mm of plate spacing, and if this quantity is divided by the area of the collecting electrode as measured by the traveling microscope, a roentgen equivalent dose is obtained. The plate spacing can be adjusted by turning the micrometers to new values, and a current reading is obtained in the time needed to make a stable curve on the Brown Recorder.

The instrument shows good stability provided it is shielded by a grounded metal case, the insulated spacing between the guard ring and the collecting electrode is kept clean, and the input capacitance of the micro-microammeter is not changed. Since the micro-micro-ammeter is a current-measuring rather than a charge-measuring instrument, the actual value of input capacitance can be neglected, and a change of input capacitance will interfere only while it is taking place, the instrument again recording the true value of ionization current as soon as the input capacitance is stable.

Reference

1. FAILLA, G. *Radiology,* **29,** 202 (1937).

Crystalline Fradicin

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Swart *et al.* (*1, 2*) have reported the presence of an antifungal agent, fradicin, in neomycin fermentation liquors. This is to describe briefly a crystalline agent, presumably fradicin, which is produced by *Streptomyces fradiae.*

The most highly purified crystalline products are light greenish-yellow. They do not show a sharp mp, but darken without definite melting between about 180° to 300° C. The solubility is less than 0.05 mg/ml in methanol, ethanol, and water, but it is greater in dioxane and in chlorinated hydrocarbon solvents such as ethylene dichloride. Fradicin also dissolves fairly readily in propylene glycol; it is practically insoluble in petroleum ether, cyclohexane, and xylene.

[1] The authors wish to acknowledge the work of O. G. Wegrich for the pathogenic fungal tests, that of J. N. Spencer for the toxicity and irritation tests, and that of J. C. Carr for microchemical analyses. The criticism of S. A. Waksman on the fungal sensitivity data is also gratefully acknowledged.

Microanalytical data indicate a tentative empirical formula of $C_{30}H_{34}N_4O_4$. *Anal.* Calcd: C, 70.01; H, 6.67; N, 10.88. Found: C, 70.29; H, 6.59; N, 10.86. This differs from actidione both chemically (*3*) and microbiologically (*2*). Neutral equivalents of 498 and 514 were obtained by two methods (*4, 5*). A molecular weight in the range of 500 was found by the Barger micro method, using dioxane. The molecular weight calculated from the empirical formula is 514.6.

Fradicin is a weak base, which forms a hydrochloride obtained as needles. The $[\alpha]_D^{25}$ of the base is about + 65° (*c* 1.0, 1,4-dioxane). Micro Zeisel analyses of the base showed 11.95% alkoxyl, probably methoxyl (Calcd: 2 CH_3O, 12.04). Alkali fusion yielded a volatile product which gave positive pine splint and Ehrlich's tests for a pyrrol. Fig. 1 shows the ultraviolet absorption spectrum of crystalline fradicin in ethanol.

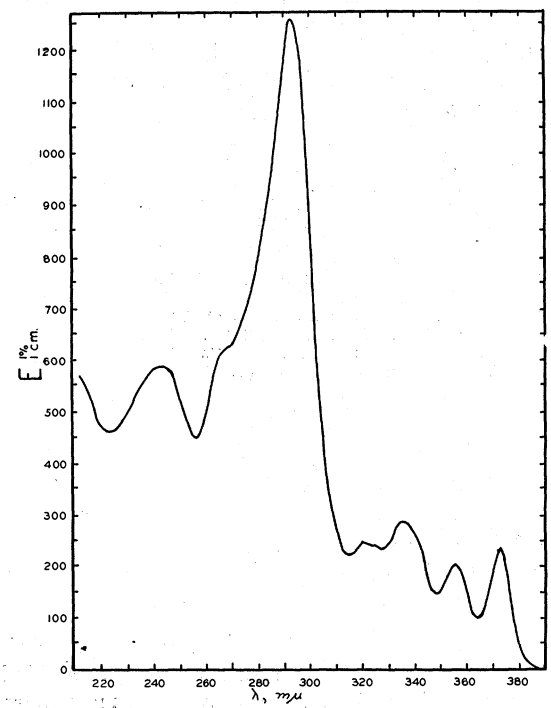

FIG. 1. Ultraviolet absorption spectrum of fradicin in ethanol.

Antifungal activity is strong at pH 7.0 and higher, but below this activity is greatly reduced. In a phenol red broth[2] at pH 7.3, activity has been demonstrated against several yeasts, including a strain of *Saccharomyces cerevisiae,* at about 0.1–0.15 μg/ml. Activity was poor against bacteria. These findings agree qualitatively with those of Swart *et al.* (*2*) for the amorphous material.

In tests using agar dilution plates[3] at pH 7.3 with 9-day incubation, inhibition was demonstrated against

[2] Difco phenol red broth base + 1% glucose + 0.1% yeast extract (Difco) + 0.1% beef extract (Difco), pH 7.3.

[3] Agar composition: peptone 1.0%, dextrose 4.0%, agar 2.0%, pH 7.3, except for *H. capsulatum,* which was studied in Campbell's medium (*6*).