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Ammonium Sulfate Concentration Conversion Nomograph for 0°

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SUMMARY

A nomograph for the conversion of ammonium sulfate concentrations at 0° is presented in which concentration is expressed both in percentage of saturation and in molarity, and the number of grams of the salt to be added to any initial volume is given.

It is well known that, for the purification of a given enzyme by salting out, choosing a narrower range of ammonium sulfate concentration may be more effective than repeated fractionation (1–5). However, when fine adjustments of ammonium sulfate concentration are used, any condition such as pH, temperature, and protein and salt concentration must be more exactly established.

The nomograph in Fig. 1 establishes the last condition accurately and conveniently. The temperature of 0° adopted is nearer to the temperatures generally employed in enzyme handling than is the room temperature adopted by others (6–7). The same nomograph may be employed with adequate precision in the range from −5° to 10° by adding algebraically 0.002 per each degree of temperature to the corresponding saturation values. The grams, y, of ammonium sulfate to be added to a volume, x, in liters, of a solution of saturation S_1 at 0° to yield a saturation S_2 at 0° have been calculated as shown in Equation 1

$$y = \frac{x\,G\,(S_2 - S_1)}{1 - \frac{VG}{1000}S_2} \qquad (1)$$

where G is grams of ammonium sulfate in 1000 ml of saturated solution, 514.72, and V is apparent specific volume of ammonium sulfate in a saturated solution, 0.5262, as calculated from values in the International Critical Tables of Numerical Data (8, 9).

This equation leads to entirely reproducible results, consistently the same as may be obtained at given values of temperature and pH, by the more traditional but often less convenient procedure of adding a volume, z, in milliliters, of saturated solution to a liter of solution of fractional saturation S_1 (10) (Equation 2).

$$z = \frac{1000\,(S_2 - S_1)}{1 - S_2} \qquad (2)$$

Solutions prepared by both equations may differ about 1% from their nominal values.

Despite the extensive use of fractional saturation to designate the actual concentration of ammonium sulfate, it would be less ambiguous to use final molarity (11). In our nomograph all of the values at 0° of fractional saturation or of molarity are both reported either for the initial or for the final concentration and it is possible to raise to 3.9 M (*i.e.* saturation) all possible solutions of molarities lower than 3.9.

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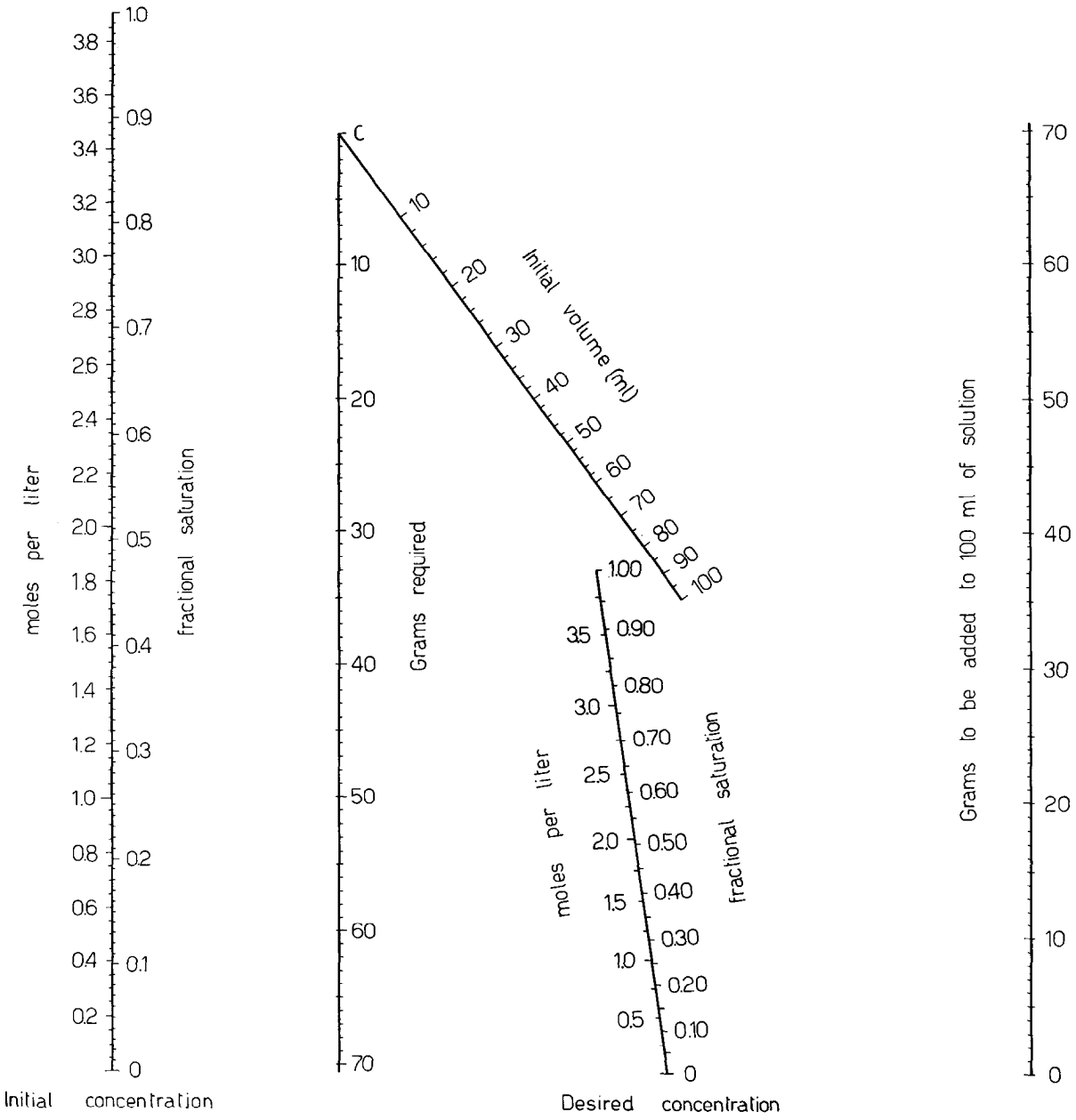

FIG. 1. Ammonium sulfate conversion nomograph for 0°. The given initial concentration and desired concentration are first joined by a *straight line*. The value from the scale on the *extreme right* is then read at the point of intersection to give the grams of solid $(NH_4)_2SO_4$ to be added to 100 ml of the solution. A line from this point through the volume at hand (*initial volume*) of the solution gives the actual amount of salt required, in grams, read from the *grams required line*. Over the temperature range −5° to 10° it is recommended that the fractional saturation values be adjusted by adding algebraically 0.002 unit per degree.