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Microbiological Death Rates

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AGGLUTINATION AND COLLOIDAL REACTIONS

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Many theories have been advanced in explaining the cause of the clumping and precipitation of bacteria by their immune serum. It is generally known that the presence of salt solution is also necessary. In many text books of bacteriology the statement is made that acids and alkalis inhibit the agglutination reaction, but amounts necessary to do this are not given. It has been observed in the present work that alkalis have a stronger inhibiting action than acids. Ammonium hydroxide has very little effect as compared to sodium or potassium hydroxide. The weak acids however have as strong an inhibiting action as the stronger acids. Lactic and butyric acids inhibit in high dilutions.

Certain colloidal solutions have distinct inhibiting action, such as soap solution, 5% acacia solution, dilute solutions of agar. Egg albumin makes the reaction slower but does not prevent agglutination.

Other substances which inhibit the agglutination reaction by their presence are saponin, bile, and bile salts as sodium taurocholate and sodium glycocholate. These substances are known to affect surface tension.

These results are offered as a preliminary report and suggest that the agglutination reaction is dependant upon changes in surface tension and other colloidal properties.

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MICROBIOLOGICAL DEATH RATES

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The form of the survivors' curve when *Staph. aureus* is subjected to the action of bactericides is not constant. It is a function of the organism and the specific bactericide and attempts to conform such curves to one generalized formula, monomolecular or polymolecular, must prove futile. Under identical conditions the survivors' curves are alike in form.

Rapidly penetrating agents such as the alcohols effect a form of

curve simulating that of a logarithmic function. Substances such as ethanolamine or diethylaminopropyl alcohol may show a marked induction period. The effectiveness of the monohydric alcohols determined on a molar basis increases with the molecular weight of the alcohol. A definite correlation is discernible when the same groups are present in the molecule between surface tension and bactericidal efficacy. A diminution of surface tension leads to increased germicidal effectiveness.

The introduction of OH groups leads to a diminution of toxicity, thus, the derivatives of propyl alcohol are in order of decreasing toxicity, propyl alcohol, propylene glycol and glycerol. The polyhydric alcohols form excellent sources of energy in bacterial metabolism. Phenyl groups substituted into the alcohol molecule greatly increase toxicity although when partly oxidized toxicity is diminished. Thus, phenyl ethyl and phenyl methyl are approximately 12 times as effective as ethyl or methyl respectively, determined by time required to kill, but when phenyl methyl has an O atom substituted for two hydrogens on the phenyl group, toxicity is reduced.

Introduction of the NH_2 group does not so markedly reduce toxicity as it prolongs the induction period, apparently a period of time when the substance is penetrating the cell. Organisms desiccated in strong sugar solutions show this effect well.

Bacteria taken during the lag period or late during the phase of death show greater susceptibility to the action of germicides than cultures in the late logarithmic or maximum stationary phase.

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