TABLE II

Mass density	Temperature	Γ	τ	$3\Gamma/\tau$	Enhancement factors
1·0 (9)	1·0 (8)	35·8	181·4	0·592	3· (16)
1·0 (9)	3 0 (8)	11·9	125·9	0·292	3 (6)
1·0 (9)	5·0 (8)	7·16	106·08	0·202	1·6 (4)
1·0 (9)	7·0 (8)	5·11	94·9	0·162	5·4 (2)
1·0 (9)	9·0 (8)	3·93	87·2	0·137	1 (2)

* Figures within bracket are powers to ten.

important. The enhancement factor due to coulomb screening is then given by (Itoh *et al.*[4]).

$$\text{Exp}\left\{1\cdot25\,\Gamma - 0\cdot11\,\tau\left(\frac{3\Gamma}{\tau}\right)^2\right\} \qquad (7)$$

The percentage of errors in the above factor is less than 1.

In the above equation (7)

$$\tau = \left\{\frac{27\,\pi^2}{4}\,\frac{M(Ze)^4}{T\hbar^2}\right\}^{1/3} \qquad (8)$$

where Ze and M denote the electronic charge and mass of ions respectively.

Carbon-carbon interaction may take place in Supernova shocks (Mitler[5]) at temperatures of the order of 10^8 K and density 10^9 g cm^{-9}. Table II shows the enhancement factors for carbon-carbon interaction as function of temperature.

It is observed that the enhancement factors due to strong screening effect decreases as the temperature rises. As the reaction rates are enhanced drastically, the carbon-carbon interaction leading to the formation of iron group of elements actually takes much less time if screening effect is given affect to.

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EFFECT OF METAL IONS ON THE ANTIMICROBIAL ACTIVITY OF SODIUM DODECYLSULPHATE

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SURFACTANTS are known to inhibit bacterial growth[1, 2]. The capacity of the surfactant to destroy cell integrity is determined by its configuration and structure[3] and also by its concentration[4].

During the course of our study on surfactants it was found that sodium dodecyl sulphate (SDS) inhibited the growth of *Bacillus subtilis* in culture and this action was influenced by some metal ions. The results of this study are presented in this paper.

An isolate of *B. subtilis* procured from Indian Institute of Science, Bangalore, was grown in nutrient broth (pH 7) at 37° C for 16 hours. The resultant growth was inoculated on Czapek's agar medium (pH 7) in petri dishes. The antimicrobial activity of SDS and the influence of metals on this activity were tested employing filter-paper disc technique. Sterile filter-paper discs (20 mm diameter) were soaked in SDS solutions of different concentrations or in 6×10^{-3} M SDS containing 10^{-2} M of any one of the following metal sulphates: cadmium, calcium, copper, magnesium, manganese, nickel, sodium and zinc. Filter-paper discs soaked in 10^{-2} M of each of the metal sulphates were also tested. Soaked filter-paper was placed on agar medium seeded with the bacterium and the inhibition zone recorded. Three replicates were maintained for each treatment. The results are presented in Table I.

The bactericidal action of SDS increased with its concentration and reached a maximum at 6×10^{-3} M. It is of interest that this concentration of SDS

TABLE I

Influence of some metal ions on the inhibitory action of SDS on Bacillus subtilis

Metal ions used	Inhibition zone diameter (mm)	
	Without SDS	With SDS
Na	..	..
Ca	..	..
Mn	..	..
Zn	28	26
Ni	..	34
Mg	..	36
Cu	40	40
Cd	..	48
SDS alone	30	

is the critical micelle concentration (CMC) for this detergent[5,6]. The antibacterial action of SDS may be due to its action on the membrane system of the bacterium, as detergents disorganise cell membrane and denature certain proteins essential for metabolism and growth[7]. Surfactants can also bring about ihhibition by altering the surface structure of cells[7] and are also known to cause cytoplasmic shrinkage in bacteria[8].

Among the metal studied, Cd^{++} and Mg^{++} enhanced inhibition by SDS though in the absence of the detergent they could not inhibit bacterial growth. The increased activity of SDS in the presence of these metals may be due to an increase in the number of micelles formed by the detergent, as salts are known to increase micelle number of surfactants[9,10]. Cu^{++} inhibited bacterial growth even in the absence of the detergent and the addition of SDS had no effect. Surprisingly, SDS lost its activity completely in the presence of Ca^{++}, Mn^{++} or Na^{+}. This may be due to these metals modifying the micelle structure[11]. Gupta *et al.*[12] reported a similar phenomenon with tetracycline hydrochloride. Addition of Ni^{++} or Zn^{++} had little influence on the inhibitory action of SDS. It is possible that these two metals alter the micelle structure in such a way that its bactericidel action was not affected.

Though Ni and Mg have similar effects, the inhibitory zone produced by Ni SDS was not distinctly sharp and well defined.

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GRIGNARD REACTION ON 3,4-CYCLOHEXENO- AND 3,4-CYCLOPENTENO-COUMARINS

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IN a project for the synthesis of compounds analogous to tetrahydrocannabinoids[1,2], we studied the action of the Grignard reagent on 3,4-cyclohexeno- and 3,4-cyclopentenocoumarins. Not much work seems to have been done in this direction although the Grignard reaction on coumarins has been previously investigated to some extent[3,4].

The starting materials, 3,4-cyclohexeno- and 3,4-cyclopenteno-coumarins were obtained by the Pechmann condensation of dimethylphenols with ethyl cyclohexanone- and ethyl cyclopentanone-2-carboxylates in the presence of sulphuric acid (80%). The 3,4-cyclohexenocoumarins and 3,4-cyclopentenocoumarins so obtained had UV λ_{max}^{MeOH}: 220 nm (log ϵ 4·34), 275 nm (log ϵ 3·98) and 320 nm (log ϵ 3·99),