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EFFECT OF PARTICLE SIZE ON DRUG RELEASE FROM OINTMENT BASES

ARIF RAHIM, SYED AYUB ALI, FOUZIA HASSAN, SYED SOHAIL ALI AND NAHEED HAQUE*
Department of Pharmaceutics, Faculty of Pharmacy, University of Karachi, Karachi-75270, Pakistan
**Department of Pharmacy, University of Baluchistan, Quetta*

ABSTRACT

The effect of particle size on the release of benzoic acid from the selected ointment bases were determined by colorimety. The results indicate that the release of drug (benzoic acid) from ointment bases is enhanced by decreasing the particle size of benzoic acid.

INTRODUCTION

Benzoiç acid has long been used as food preservatives and the list employing the chemical has grown yearly (Oshima, 1996; Downard, 1995). When used as preservative in foods and in pharmaceutical products, benzoic acid and its salts are more effective as the pH is lowered; thus it is the undissociated benzoic acid molecule which is the effective agent (Wilson, Grisvold, 1976). The coupling of effective bactericidal and bacteriostatic action with relative non-toxicity and tastelessness have elevated benzoic acid and the benzoates to a wide range of food preservative applications. In slightly acid medium benzoic acid prevents bacterial growth in concentrations of only 0.1%. Changes in the pH of the medium greatly affect the bactericidal and bacteriostatic action of the benzoates; an alkaline pH lowers the action manifold. Best result are obtained in foods in which the acidity ranges from pH 2.5-4,5 (Erikothmer, 1990). Benzoic acid and sodium benzoate are now used as preservatives in the following foods; sauces, pickles, cider, fruit juices, syrups and concentrates, mincemeat and other pie fillings, margarine, egg powder, fish, bottle carbonated beverages, and fruit preserves, jam and jellies. In such uses the sodium salt is generally more useful owing to its greater water solubility. The FDA Federal Law permits the use of sodium benzoate in any food except tomato ketchup with a tolerance of 0.1%, if proper labeling plainly shows the presence of the chemical as a preservative.

In the present work the release of benzoic acid in ointments formulated with various bases of different particle size have been evaluated.

MATERIALS AND METHOD

There are five types of ointment formulations containing different ointment bases. The ointment bases were prepared according to the Fusion method (B.P. 1988). The detail of the method was described elsewhere (Rahim, 1995).

RESULTS AND DISCUSSION

The results of our study shows that rate of release of benzoic acid increases as the particle size of the benzoic acid is decreased. The study the particle size effect, a wide range of particle sizes of benzoic acid were taken i.e. 250 mm, 200 mm, 160 mm and 80 mm. The highest release was obtained from particles of 80 mm size and lowest from the particles of 250 mm size. on the basis of results obtained, the particle size of benzoic acid can be classified, according to the release rate, as follows:

80 μm > 160 μm > 200 μm > 250 μm

Particle size, in other word, the increased surface area of the medicament incorporated in the ointments increased the release rate markedly. Efficacies of benzoic acid ointments increased persistently s the particles of benzoic acid became smaller. This result was observed in all the selected ointment bases, with the fact that different ointment bases showed different magnitude of release, for the same particle size of benzoic acid.

The reason for the observed differences in efficacies of ointments containing the same amount of benzoic acid but of different particle size is attributed as given above, but the cause seems to be linked with biological availability. Availability itself may be related to the transfer rate of benzoic acid from an ointment base to the biological skin under treatment, represented in this in-vitro technique by agar medium. Medicament transfer, across the ointment skin interface only occurs in solution; with solid medicament, transfer depends on the mount of medicament in solution at the interface, since smaller particles with larger surface areas dissolve much more readily than larger particles, the smaller crystals conceivably dissolve in the ointment bases and build up relatively higher concentrations at the interface for partitioning to the skin. The current work suggests that when the total amount of particulate benzoic acid incorporated in different ointment base is fixe,d then efficacy depends primarily upon availability, which itself is depends on particle size and surface area.

From the results of the present study it can be concluded that smaller the particle size of the benzoic acid higher the release of benzoic acid from the ointment bases. This can be shown as follows:

80 μm > 160 μm > 200 μm > 250 μm.

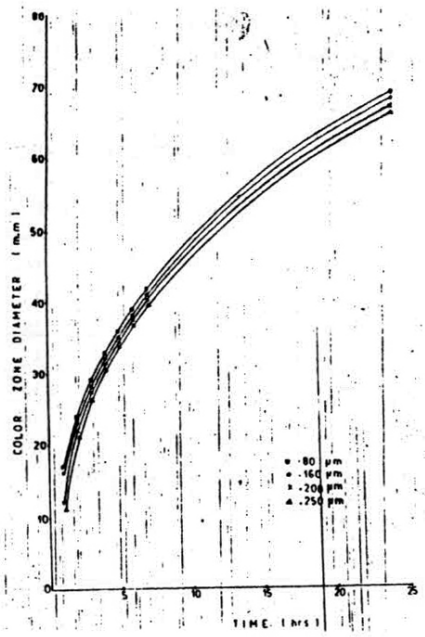

Fig. 1: Release of benzoic acid from polyethylene glycol ointment.

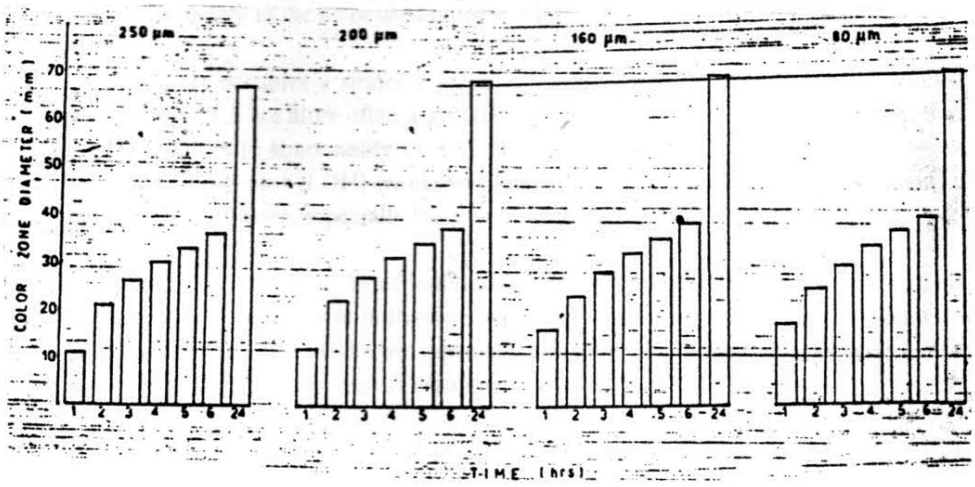

Fig. 2: Bar chart representation of benzoic acid release from polyethylene glycol ointment.

Table 1
Release of Benzoic Acid from Polyethylene Glycol Ointment

Time (hours)	Colour zone diameter (mm)			
	250 mm	200 mm	160 mm	80 mm
1	11	12	16	17
2	21	22	23	24
3	26	27	28	29
4	30	31	32	33
5	33	34	35	36
6	36	37	38	39
24	67	68	69	70

*Each reading is an average of six readings.

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