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Study on Effects of Urethane (Ethylcarbamate, $C_3H_7NO_2$) on *Cyprinus carpio*

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Abstract: The study was carried out to determine the anaesthetic effects of urethane ($C_3H_7NO_2$) on *C. carpio*. No differences were observed on fish behaviour and physical and chemical characteristics of water at 1, 2, 3 and 4 mg/l concentration of urethane. Differences were observed either in fish behaviour or water characteristics at higher concentrations. Results in this study showed that the anaesthetic effects of urethane for *C. carpio* were evident at high concentrations (100-150 mg/l) in 30 minutes. Urethane was effective to the fish at 100-125 mg/l concentration in 18 minutes and then lost its effects.

Key words: Effects, urethane, *Cyprinus carpio*

Introduction

In order to prevent fish activity and decrease oxygen consumption and trauma during live fish transport, some anaesthetics are used. Tricaine methanesulfonate ($H_2NC_6HCO_2C_2H_5$. CH_3SO_3H/ MS-222), quinaldine (2-4 methilchinolin) (Dupree and Huner, 1984; Stickney, 1992), sodium amytal (Leitritz and Lewis, 1976), Combelen (Berka, 1986) are the most commonly used chemicals for this purpose in fisheries. These chemicals are used in different concentrations for fish. At optimum concentration fish behave normally, but respiration and activity decrease. One of the other commonly used chemicals is urethane (ethylcarbamate, $C_3H_7NO_2$).

Optimum concentration of urethan for *C. carpio* has not been determined previously. Only information on use of urethan concentration when transporting *C. carpio* to decrease fish activity is 1-4 g/l (Chakroff and Crops, 1982). *Cyprinus carpio* used in this study is the most common and widely consumed fish species by people in Turkey. So objective of the study was to determine the anaesthetic effects of urethane on *C. carpio* which is an economically important fish species in the study area.

Materials and Methods

Twenty *C. carpio* (weight range = 22.0-200.0 g. and total length range = 12.0-25.3 cm) were used. The study was carried out between July and September 2000 at Fish Disease Laboratory, Firat University, Turkey. Pure urethane was dried at 103 °C for 15 minutes. Then, from dried urethane concentrations of 1, 2, 3, 4, 5, 7.5, 10, 15, 20, 30, 40, 50, 75, 100, 110, 125, 150, 250 and 500 mg/l were prepared in volume of 10 l glass aquariums by dilution method. One small (<50g) and one big (50-200g) *C. carpio* were transferred into each concentration and were let to stay for 30 minutes.

Water used in all aquarium had same characteristics, of which pH, temperature and dissolved oxygen were measured, (Anonymous, 1987). Same characteristics of water were also measured after 30 minutes. Behavioural changes of *C. carpio* in each concentration during 30 minutes were observed and noted twice by two people.

Results and Discussion

Initial water characteristics are given in Table 1. No differences were observed in fish behaviour and physical and chemical characteristics of water at 1, 2, 3 and 4 mg/l concentration of urethane. Differences were observed either in fish behaviour or water characteristics at higher concentrations and are given in Table 2.

Relationship between different concentrations and pH, dissolved oxygen are shown in Fig. 1 and 2. No evident changes were determined at the value of pH and dissolved oxygen between 5-150 mg/l urethane concentrations. But, a clear increase in pH and decrease in dissolved oxygen level were seen at 250-500 mg/l concentration of urethane (Table 2). These changes caused fast breath of *C. carpio*.

The best and simple method when transporting fish is to carry in cold water (Woynarowich and Horvath, 1980), since oxygen dissolving capacity is high in cold water. But this is not true for all fish species. Moreover, this method is not used for live fish when taking blood and parasitological examination. According to Strebkova (1971), there is no difference between the fish anaesthetized or transported at 11-13 °C. But, when the temperature increases over 15 °C which cause O_2 decrease, the fish must be anaesthetized (Horvath *et al.*, 1984, Özdemir, 1994). When transporting and examining the living fish, tricaine methanesulfonate (MS-222) and quinaldine are the most commonly used anaesthetics (Stickney, 1992). Concentration of urethane used for different fish species is not well known.

Table 1: The characteristics of water at the beginning of research in aquarium.

Parameters	
pH	7.59
Temperature (°C)	21.50
Dissolved Oxygen (mg/l)	6.94
Hardness ($CaCO_3$)	310.00

Horvath *et al.* (1984) suggested that optimum dose of MS-222 for carp and catfish is 10-20 mg/l and 35 mg/l respectively. Rzanicanin and Balcer (1974) indicated that the applicable concentration of MS-222 for carp must be 50 mg/l.

It is proposed that quinaldine is easily used for tropical fish species at concentrations of 15-30 mg/l (Dupree and Huner, 1984). Again, Dupree and Huner (1984), claimed that MS-222 causes the change in pH level of water and to prevent these changes and keep pH levels 7-8, a buffer solution must be added to the water. The study carried out to determine the anaesthetic effects of urethane ($C_3H_7NO_2$) on *C. carpio*, showed that there is no need to add buffer of oxygen source up to 150 mg/l concentration, but buffer and oxygen resource are necessary at higher concentrations of urethane. Results in this study also showed that anaesthetic effects of urethane for *C. carpio* appears in high concentrations (100-150 mg/l) in 30 minutes. Being effective at 100-125 mg/l concentration in 18 minutes then losing its effects and continuing effects of urethane at 150 mg/l showed a decrease in its effects by the time. Thus, it can be speculated that

Table 2: Changes in *C. carpio* behaviour and characteristics of water at various concentrations of urethan.

Concentration (mg/l)	pH	Dissolved oxygen (O_2 mg/l)	Observation
1-4	7.59	6.94	No any abnormality
5.0	6.71	6.57	Less activity in 30 minutes
7.5	6.75	6.45	Increased activity between 1-20 mins. and then no activity for last 10 min.
10.0	6.79	6.40	Same as above
15.0	6.90	6.51	Gradual decrease in activity between 1-30 min.
20.0	6.90	6.66	No activity between 1-20 min. Then increase in activity between 20-30 min.
30.0	7.01	6.90	Same as above
40.0	6.99	6.70	Same as above
50.0	6.99	6.70	No activity between 1-10 min. Gradual increase in activity between 10-30 min.
75.0	6.99	6.77	Gradual decrease in activity between 1-20 min.
100.0	6.97	6.69	No activity and unconsciousness between 1-18 min. and gradual increase in activity between 18-30 min.
125.0	6.96	6.71	Gradual and continuing decrease in activity between 1-30 min.
150.0	6.97	6.73	Same as above
250.0	7.40	6.50	Hyperactivity between 1-10 min. No activity and fast breathing between 10-30 min.
500.0	7.48	6.10	Same as above

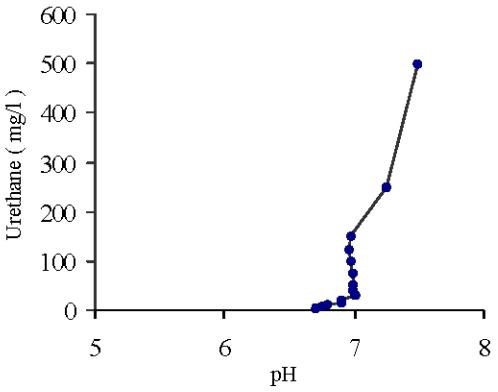

Fig. 1: Relationships between different concentrations of urethan and dissolved oxygen level.

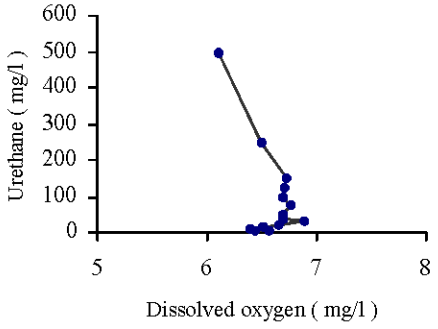

Fig. 2: Relationships between different concentrations of urethan and pH level.

urethane is effective for 30 minutes, in order to use longer periods , it must be added into water little by little.

In conclusion, it can be said that to transport and examine alive *C. carpio*, urethane is effective at concentrations of 100-150 mg/l and is a good anaesthetic because it does not effect pH and dissolved oxygen of water.

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