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Use and Application of Salt in Aquaculture

L. Swann
Purdue University

S. Fitzgerald
Purdue University

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Abstract

Salt is one of the most commonly used drugs in aquaculture. In fact, it is sometimes referred to as the aspirin of aquaculture. Salt, or sodium chloride (NaCl) in its chemical form, is a drug of low regulatory priority for the United States Food & Drug Administration and requires no withdraw-d time before marketing. Many forms of salt are used, including table, meat-curing, pickling, and rock salt. Of these, the most commonly used and least expensive form is the meat-curing variety. When used properly, salt can treat many external parasites including Costia, Epistylis, Trichodina, Chilodonella, and the flukes Dactylogyrus and Gyrodactylus. Salt is used to relieve stress during handling and transport.

Disciplines

Aquaculture and Fisheries

Comments

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North Central Regional
Aquaculture Center

In cooperation with USDA

Use and Application of Salt in Aquaculture

Prepared-by-L. Swarm, Illinois-Indiana Sea Grant Program, Purdue University, and S. Fitzgerald, D.V.M., Animal Disease Diagnostic Laboratory, Purdue University, West Lafayette, IN

Background

Salt is one of the most commonly used drugs in aquaculture. In fact, it is sometimes referred to as the aspirin of aquaculture.

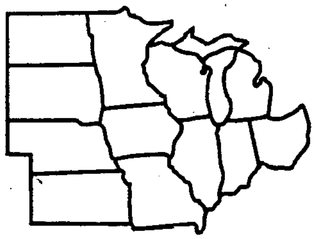
Salt, or sodium chloride (NaC1) in its chemical form, is a drug of low regulatory priority for the United States Food & Drug Administration and requires no withdraw-d time before marketing.

Many forms of salt are used, including table, meat-curing, pickling, and rock salt. Of these, the most commonly used and least expensive form is the meat-curing variety. When used properly, salt can treat many external parasites including *Costia, Epistylis, Trichodina, Chilodonella,* and the flukes Dactylogyrus and Gyrodactylus. Salt is used to relieve stresss during handling and transport.

A few general guidelines are suggested before any salt treatment is attempted:

1. Use sensitive and accurate scales to calculate doses for treatment of small volumes of water contained in hauling or holding tanks. “Guesstimating” may only end in disaster.
2. Know the volume of your ponds, airways, tanks, etc., beforehand. It is advisable to have those values in a convenient location for immediate use.
3. Perform a test treatment on a few fish before attempting a large-scale treatment. Salt, like other chemicals, reacts differently among different species and water qualities.
4. Prepare to remove fish or flush out salt baths with fresh water when fish show initial signs of stress.

Treatment procedures involve calculating the volume of water to be treated, calculating salt dosage, and choosing the treatment method. In the case of a specific disease, the corresponding rate of salt for applications needs to recalculated.



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Treatment Methods

The method of salt application depends on the disease organism, fish species, weight, and type of aquaculture unit. Treatment methods include short-term dips, prolonged baths, and indefinite treatments.

Dip treatments involve exposing the fish to very strong solutions for short periods of time, usually 30 seconds to one minute.

Prolonged baths are useful for heating fish in small tanks that can be flushed quickly. Strong solutions of salt are added to the water. Fish are held in this salt solution with aeration from 30 to 60 minutes, or until they show signs of stress.

Indefinite treatments are used when-transporting, handling fish, or when dealing with large volumes of water, such as ponds. Low concentrations of salt can be used indefinitely in ponds.

Calculation of Volumes

Calculating tank and pond volume is an important step to effective salt application in aquaculture. Measurements used to determine volume are usually in feet and/or inches. The most common shapes of culture tanks, ponds, or raceways are square, rectangular, or round.

Square or rectangular pond and tank volumes are calculated similarly except that an average depth is used for ponds. The method used to calculate volume of each is given below.

Volume of a square or rectangular raceway, tank or pond.
  Volume (Vol.) = Length x width x depth

Example 1: A rectangular tank is 12 feet (ft.) long, 3 ft. wide and 3 ft. deep. What is its volume?
  vol. =12 ft.x 3 ft. x 3 ft.
  Vol. = 108 cubic ft. ($ft.^3$)

Volume of a round tank
  Vol. = 3.14x (radius x radius) x depth

Example 2: A round tank is 12 ft. in diameter and 4.5 ft. deep. What is its volume? (Radius = 0.5 x diameter)
  Vol. = 3.14 x (radius x radius) x depth
  Vol. = 3.14 X (6 ft. x 6 ft.) x 4.5 ft.
  Vol. = 3.14 X 36 $ft.^2$ x 4.5 ft.
  Vol. = 508.7 $ft.^3$

Calculation of dosages

Once the volume is calculated in cubic feet, the gallons are determined using these conversions:
  1 ft^3 = 7.48 gallons (gal.)
  1 acre-foot (1 surface acre x 1 ft. deep) = 325,850 gal.
  1 liter (L)= 0.26 gal.

Other useful conversions:
  1 pound (lb.)= 454 grams (g)
  1,000 g = 1 kilogram (kg)

Table 1. Specific treatments and methods of using salt for treating various diseases or as a remedial treatment of stress.

Disease	Concentration and duration of treatment for control of disease
External parasites of brood fish	30,000 ppm (3%) as quick dip (15 seconds) before stocking
External parasites *Costia, Epistylis, Trichodina,* and *Chilodonella* and the flukes Dactylogyrus and *Gyrodactylus*	10,000-30,000 ppm (l-3%) prolonged treatment (30 minutes or until fish show signs of . stress) or 1,000-2000 ppm in hauling tanks as an indefinite treatment
Stress during transport and while handling	Indefinite treatment using 1,000-10,000 ppm (0.1-1.0%)

One of the most commonly used units of measure in aquaculture is the part per million, commonly referred to as ppm. In percentage calculations, 1% equals 10,000 ppm. The amount of salt added to various volumes that results in 1 ppm concentrations is listed below.
  1 ppm equals:
  2.7 lb./acre-foot
  0.0283 g/$ft.^3$
  0.00378 g/gal.
  1.0 milligram (mg)/L

Example 3: How much salt is needed to make a 2% solution using a prolonged treatment for *Dactogyrus in* the round tank used in Example 2?
  2.0% = 20,000 ppm
  tank volume (gal.) = 508.7 ft^3 x 7.48 gal./ft^3 = 3,805.1 gal.
  salt needed(g) = 0.00378g/gal. x 3,805.1 gal. x 20,000 = 287,663g or 633.6 lbs. ($\frac{287,663g}{454g/lb.}$ = 633.6 lbs.)

Example 4: How much salt is needed to make a 0.570 solution using an indefinite treatment in a 100-gal. transport tank?
  0.5% = 5,000 ppm
  Salt needed(g) = 0.00378 g/gal. x 100 gal. x 5,000 ppm
  Salt needed(g) = 1,890 g or 4.2 lbs. ($\frac{1890g}{454g/lb}$ = 4.2 lbs.)

Specific treatment rates

Specific treatments using salt are given in Table 1.

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