able skirts allows for a variety of colors and fabrics, and to meet existing adverse conditions, e.g, 3.6 g rattan stiffener threaded through one skirt for wind resistance.

Tail photo technique. TOM WOODS and SHERI WILLIAMSON

No abstract

Physical and chemical properties of various sugar water ratios for hummingbird feeders. ROSS DAWKINS, *Dept. Chem. & Biochem., Angelo State University, San Angelo, TX.*

Most people using sugar water for hummingbird feeders use a recipe ratio involving volumes of water (solvent) to volumes of dry granular sugar (solute) or they measure the final volume of the solution instead of added solvent. In either case it is not easy to compare one recipe to another as far as energy content or total amount of sugar. We have made up a series of sugar (sucrose, Imperial Pure Cane granulated) solutions using the percentage volumes of water and dry sugar. We have then measured the density, molarity, molality, calories/gal and freezing point of various ratios. Density (or the similar specific gravity) is measured easily in the field. The molarity (M) is a normalized method of measuring the moles of solute per volume of final solution. This makes comparisons between solutions easy. The molarity (*m*) measured the moles of solute per kilogram of solvent. This helps calculate colligative properties such as freezing point or boiling point of any solution. From the molarity, the number of calories/gal can be calculated. This can be converted to calories or to joules easily. The results are in tabular form and interpolated into graphic form.

Table of Characteristics

V% water/ V% sugar	Molarity M	Molarity m	Freezing Point (F)	Density g/mL	kCal/gal
33/67 (1:2)	2.31	4.97	15	1.256	11.96
50/50 (1)	1.58	2.485	24	1.174	8.18
60/40 (1.5:1)	1.20	1.66	26	1.132	6.21
67/33 (2:1)	0.965	1.24	28	1.107	5.00
75/25 (3:1)	0.695	0.828	29	1.077	3.60
80/20 (4:1)	0.543	0.621	30	1.058	2.81

Sugar preferences of Black-chinned Hummingbirds at a mega feeding station in Texas. ROSS DAWKINS, *Dept. Chem. & Biochem., Angelo State Univ., San Angelo, TX.*

At Dan Brown's ranch near Christoval, TX, approximately 3,000 Black-chinned Hummingbirds regularly feed during the breeding season. Dan feeds more than 800 lb of cane sugar (sucrose) during the year. At this location, we tested various sources and types of sugar and different concentrations of sugar to see if preferences existed. The sugars tested were sucrose from beet sugar (Albertson's Granulated Sugar), cane sugar (Imperial Pure Cane Sugar), fructose (Eastman Organic Chemicals), glucose (Reagent Grade), and high fructose corn syrup (Betty Crocker Corn Syrup). One cane sugar solution was 80.0 ml of deionized water (80.0 g) added to 20 ml of dry, granular sugar (17.7 g sucrose) and this was designated as CS4. A second cane sugar solution was 90.0 ml of deionized water (90.0 g) added to 30 ml (26.5 g sucrose) of cane sugar. This was designated as CS3. The other solutions were like CS4 with 80.0 ml of deionized water added to 17.7 g. of sugar. These solutions were BS (beet sugar), G (glucose), F (fructose), and K (Karo-type high fructose corn syrup). 70.0 ml of each solution were placed in clear, new Perky Pet single port feeders with a bee guard. A six feeder array was assembled in oak (*Quercus fusiformis*) shade in a 2x3 arrangement. Feeders were 2 m above the ground and 1.5 - 2 m apart. A second six feeder array was set up under the back eaves of Dan's house in a linear arrangement. Again, feeders were 1.5 - 2 m apart. After each sample period, volumes were measured and feeders switched with higher and lower usage feeders exchanged to zero out positional variables. In addition, sampling periods were varied as to time of day from 8 Jul - 11 Jul. Dan's normal complement of about 20 two-liter feeders were also available the whole time. Results were tallied by place of finish in each time period. The places of finish were then averaged over the four-day period. The results were fructose (average place 1.7) slightly preferred to beet sugar (average place 1.8). Next were Cane Sugar 3 (CS 3) (average place 2.8) followed by Cane Sugar 4 (CS 4) (average place 3.8). Last were glucose (average place 5) and high fructose corn syrup (average place 5.9). A second method of comparison was by total volume of solution