Fluoride Ion release profile of **Profisil®** Fluoride Varnish

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PURPOSE

The purpose of this study was to determine the fluoride ion release from Kettenbach's Profisil® Fluoride Varnish that contains a sodium fluoride salt. The ion release profile was measured for 24 hours.

METHODS AND MATERIALS

Specimen Preparation

The Profisil® Fluoride Varnish was transferred into washers (Nylon standard flat washers obtained from Washers USA: Outer dimension: 0.625", inner dimension: 0.375", thickness: 0.032") that were adhered to glass microscope slides (Fisherfinest® premium microscope slides, 3" x 1" x 1 mm) using a standard water-resistant adhesive (Amazing Goop®). The prototype varnish formulation was applied from the container into the adhered washers. It was added and smoothed with a spatula until a uniform surface was achieved. Four washers were adhered to each slide. Eight slides (for a total of 32 washers) were used to measure fluoride release from the formulation. Each slide was weighed before and after the prototype pit and fissure sealant formulation was placed.

The slide-holding dish and stir bar were disinfected using a bleach solution and ethanol solution. They were then rinsed with ultrapure water, blotted dry with a Kimwipe, and placed on a clean surface near an active Bunsen burner. The slide dishes were loaded with the eight slides. Once all eight slides were loaded, 100 mL of ultrapure water was added. One mL aliquots were taken immediately at time zero, one hour, two hours, three hours, four hours, five hours and 24 hours. It is important to note that the volume taken from the bath during each aliquot was refreshed afterwards with the same volume of ultrapure water. Samples were stored in microcentrifuge test tubes (Fisherbrand®) until ion concentration measurements were performed.

Ion detection

Potentiometry was utilized to determine the concentration of fluoride ions. An ELIT 8221 fluoride specific electrode was used for the fluoride ion. An ELIT 001N silver chloride electrode served as the reference. First, the ion specific electrode (fluoride) was primed by soaking in a solution of its corresponding ion (1000 ppm fluoride solution). This was done for at least 30 minutes prior to the experiment. Standard solutions were added to cleaned 50 mL beakers (with stir bars). Once the electrode soak was completed, it was rinsed with a stream of ultrapure water. A Kimwipe was used to wipe the electrode and blot the membrane dry. Next, the parafilm and cap were removed from the reference electrode and are rinsed with ultrapure water and blotted dry. Both the reference and the ion electrodes were inserted into the 201 dual head BNC connector. The beaker containing the lowest ppm standard was placed underneath, and the electrodes were lowered so that they were submerged into the solution without touching the spinning stir bar. The electrodes are set approximately half-way into the 10 mL standard. Next, the electrodes were tapped gently to remove any air bubbles that may have formed near the membrane. Calibration measurements were then performed using the software. Millivolts are recorded after two minutes, and the remaining standards are measured in the same fashion. The software then reported the slope of the calibration measurements. When the slope fell within range, the electrodes were ready for use (fluoride slope range: -54 ± 5 mV/decade).

Sample aliquots were then added to volumetric flasks. To the sample, a solution buffer was added next, per manufacturer's instructions. For fluoride samples, 5 mL of a special TISAB (total ionic strength adjustment buffer), was added. [The TISAB was prepared per manufacturer's instructions: 57 mL of acetic acid, 45 grams of sodium chloride and 4 grams CDTA (1,2-diamino cyclohexane N,N,N,N-tetra acetic acid) were dissolved in 500 mL distilled water. The pH was adjusted to 5.5 using 5.0 M NaOH, one drop at a time. The TISAB solution was increased to a total volume of 1 L using ultrapure water.] Next, the samples were diluted with ultrapure water. Once the total volume of the aliquot, buffer, and water approached the fill line on the neck of the flask, a Pasteur pipette was carefully used to dilute the rest of the solution to 10 mL. The dilution factor for the sample was calculated. The volumetric flasks that contained the samples were capped and gently agitated by inverting the flask 10 times. The sample solutions were poured into beakers (with stir bars) for fluoride concentration measurements.

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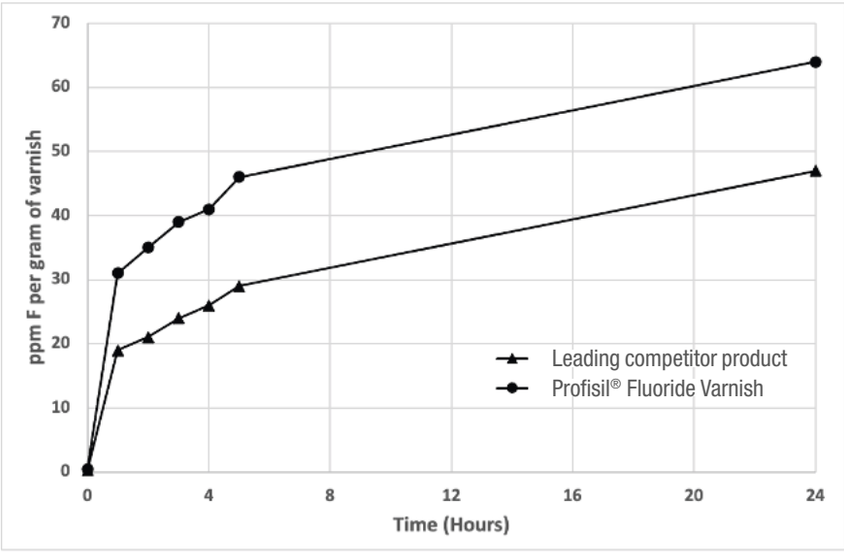
The millivolt readings and slope were recorded for each sample. From these measurements, the concentration of the samples were ascertained using the Nernst equation, Ecell=Eθcell–(RT/nF)lnQ, where Ecell represents the cell potential (electromotive force), Eθcell represented the standard cell potential at the temperature of measurement (e.g. 25 oC), R is the universal gas constant (8.314 J K-1mol-1), T is the absolute temperature (e.g. 298 K), n is the number of moles of electrons transferred in the cell reduction, and F represented Faraday's constant (9.648 x 104Cmol-1). The equation could also be revised as: Ecell=Eθcell–(2.303*RT/nF)logQ. The unknown concentration was determined and was multiplied by the appropriate dilution factor to determine the actual ppm of the sample. Samples were measured in triplicate.

RESULTS

The table below reports the fluoride ion released from Profisil® Fluoride Varnish and is compared to the fluoride ion released from a leading competitor product. The data on the y-axis represents the ppm of fluoride ions released per gram of varnish. The x-axis represents the time that the varnish was soaking in water.



This graph represents cumulative fluoride release from the 2 varnish compositions. While Profisil® Fluoride Varnish releases more fluoride after 24 hours the total amount is far less than fluoride mouth rinses which contain from 100 to 3000 ppm of available fluoride.