

# Hot Piranha: Amazonian Fish, Deadly Chemical and Summer Engineering Physics Mascot

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As is customary in the Engineering Physics community here at the University of Alberta a few selected garments are available to be ordered. This summer the Engineering Physics club presents an offering of 4 colors of screen printed **ALSTYLE APPAREL** unisex T-shirts. Unlike previous clothing orders displaying general contempt of the animal kingdom [1] we celebrate the animals belonging to the genus: *Catopirion*, *Pygopristis*, *Pristobrycon*, *Serrasalmus* (*Pirambebas*), and of course *Pygocentrus*.

## I. INTRODUCTION

Piranhas or pirañas are the common name to a number of species of carnivorous freshwater fish living in the Amazonian River basin. Normally 6 to 10 inches in size, piranhas are renown for their sharp teeth and ability to strip flesh from a carcass. The piranha is an intelligent fish, often hunting strategically immobilizing their prey by attacking the fins, tails or eyes of other individuals [2].

Piranha is a 3:1 mixture of concentrated sulphuric acid  $H_2SO_4$  and 30% hydrogen peroxide  $H_2O_2$ . Boiling piranha is commonly used for cleaning organic deposits such as oily fingerprints and the residue of a common household sneeze from the surfaces of substrates used for microfabrication. The strength of this solution is reminiscent of the ferocity with which organic carcasses are consumed by the acids biological counterparts, it is often considered alongside hydrofluoric containing acids as the most dangerous present in many chemistry laboratories. Immersion of silicon wafers with a native oxide in piranha changes the surface chemistry to one of very low hydrophobicity [3], an important property for certain surface activation processes.

Recent attention has also been paid to the species after which the microfabrication chemical was named. Falling at the end of many food chains, piranhas are suitable for use as markers for accumulation of heavy metals. Mercury accumulation potentially presents a threat to aboriginal communities using the fish as one of their main sources of dietary protein. A survey of the Hg accumulation in the species *piranha branca* and *piranha preta* living in the Rio Negro basin (a 690 x 10<sup>3</sup> km<sup>2</sup> subsection of tributaries of the greater amazon river system) was made in 2003 [4]. Baseline Hg concentrations present in these fish were recorded and future monitoring of these levels can be used for evaluation of the environmental impact of gold mining, a potential source of heavy metal contamination, takes place in the Rio Negro Basin.

The various applications, world renown reputation, potential for significant contributions to society, and abnormal intelligence of Piranha, in both its chemical and biological manifestations, are traits naturally associated with the Engineering Physics community. Fig. 1 displays the screen printed logo that will appear in white on the front of T-shirts ordered.

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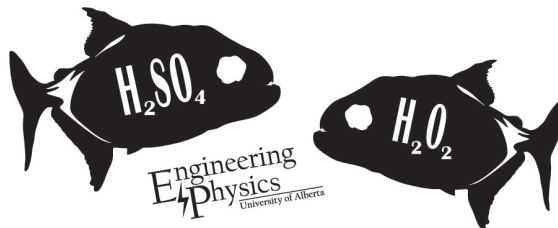


FIG. 1: The piranhas to be displayed on Summer 2007 Engineering Physics clothing order.

## II. ORDERING

Please print a copy of this document and fill out the details below. Return it to the Engineering Physics Club office ETLC E2-040F (In the clubs hallway, usually occupied between 12:00-13:00) by **June 29, 2007** or give it to your friendly neighbourhood Engineering Physics student to bring there for you.

- Name:
- Email address:  
(For contact purposes when the shirts are ready for pickup)
- Color (circle one): Navy Harbour-Blue Black Coffee
- Size (circle one): Small Medium Large XLarge
- Please staple \$15 to this page and submit by **June 29, 2007**.

## III. ACKNOWLEDGEMENTS

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[1] V. Sauer, Engineering Physics spring clothing order **1**, 3 (2007).

[2] R. M. Foxx, Animal Behaviour **20**, 280 (1972).

[3] L. D. Eske and D. W. Galipeau, Colloids and Surfaces A: Physicochemical and Engineering Aspects **154**, 33 (1999).

[4] J. G. Drea, A. C. Barbosa, J. Souza, P. Fadini, and W. F. Jardim, Ecotoxicology and Environmental Safety **59**, 57 (2004).