THE INFLUENCE OF SWIMMING POOL TREATMENT PRODUCTS IN REDUCING THE COEFFICIENT OF FRICTION IN GLAZED CERAMIC TILES

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1. INTRODUCTION

The concept of coefficient of friction (COF) was introduced by Leonardo da Vinci in the 16th century and has since continued to be studied by several philosophers, scientists and engineers. COF is the term used for the constant relationship between the friction force and the normal force. Slip occurs when there is a sharp drop in COF between the moving body and the supporting surface. It is characterized by loss of balance due to an unexpected and out-of-control slip of the foot. The COF depends on the micro and macro roughness of the surfaces, the repulsion and attraction forces and the viscoelastic properties of the materials. Factors such as contact area, contact time, speed, pressure and interaction with the material influence the friction coefficient. Slip resistance is not intrinsic to the surface material, but depends on multiple factors, such as the type of sole, environment and user interaction. Rough surfaces may have greater slip resistance, but they are more difficult to maintain and clean. Choosing ceramic tiles with an appropriate COF is essential to increase user safety. Furthermore, adopting regular cleaning and maintenance practices for ceramic tiles is crucial for maintaining the coefficient of friction over time.

The main objective of this study is to analyze the influence of the pool treatment product on reducing the coefficient of friction in glazed ceramic tiles intended for use on pool edges and external areas.

2. MATERIAL AND METHODS

To carry out this study, 3 samples of ceramic tiles with a rough surface were selected for different commercial applications, namely: Velvet, Natural and Protective, as show in figure 1:

Figure 1 *– Image of three products in the study*

The study was divided into three parts, the first (A) being the preliminary evaluation of the friction coefficient of a standard sample using a British pendulum following the ASTM E 303 standard. In the second stage (B), specimens were prepared in formats measuring (11 x 11) cm and abraded at 12,000 cycles, using the methodology set out in ISO 10545-7. After abrasion, the samples were cut to make test specimens compatible with the British pendulum method, which were then tested. In the third and final stage (C), sodium dichloroisocyanurate dihydrate, commercially known as granulated chlorine, a swimming pool treatment product, was selected as chemical agent. The chemical agent was prepared according to the manufacturer's instructions and applied to the surface of the samples for a period of 24 hours, followed by light cleaning with water and subsequent drying of the surface, maintaining a film of the product impregnated on the surface for carrying out the test with the pendulum.

3. RESULTS AND DISCUSSIONS

Table 1 shows the average values obtained and the standard deviation for each sample tested in their respective conditions, and the loss of performance in relation to the standard condition (A). It is noted that in condition (B) there is a sharp drop in values for the three samples tested, due to the abrasion caused in the test, where the greatest loss occurred in the sample designated "natural", reaching a drop of 52.11% of the COF value in relation to the standard. For condition (C), the sample also showed the largest decrease among the three tested, with a 16.90% decrease in relation to the standard (A). The sample designated "velvet" was the one that showed the lowest property loss, with a decrease of 35.09% for condition (B). However, for condition (C), it showed an increase in its COF of 5.26%. To facilitate understanding, figure 1 presents a graph of the conditions tested versus sample results.

	Condition	COF (BPN)	Performance related to STD (%)
Velvet	B	37 ± 2	-35,09
Std 57 (BPN)	C	60 ± 6	+5,26
Protective	B	38 ± 0	-48,65
Std 74 (BPN)	C	79 ± 1	+6,76
Natural	B	34 ± 1	-52,11
Std 71 (BPN)	C	59 ± 2	-16,90

Note: BPN = British Pendulum Number

Table 1 *– Results of the average Coefficient of Friction values.*

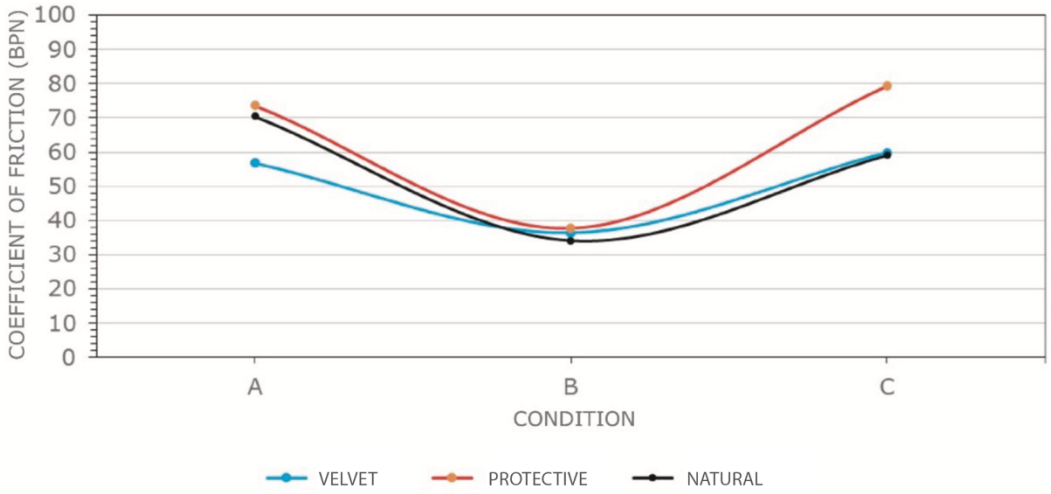

Figure 1 *– Graph of the average COF results of the samples.*

4. CONCLUSIONS

It is concluded that the application called "velvet" was the most efficient. Although it did not present the highest coefficient of friction (COF) values, this application had the smallest loss of performance compared to the other conditions analyzed. In second place, there was the "protective" sample, followed by the "natural" sample, which showed the greatest loss of properties.

5. REFERENCES

[1] SCORISA, Murilo Milani *et al*. Breve Descrição dos Métodos de Avaliação da Resistência ao Escorregamento de Revestimentos Cerâmicos. **Cerâmica Industrial,** 2016. Available at: https://www.ceramicaindustrial.org.br/article/587657627f8c9d6e028b4845/pdf/ci-21-3-587657627f8c9d6e028b4845.pdf. Accessed on 15 Sept. 2023.