

# Inhibition of *Candida albicans* adherence by natural products

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## Introduction

*Candida albicans* is a highly successful opportunistic pathogen, causing both superficial and systemic infections in both immunocompetent and immunocompromised patients [1,2]. The increased incidence of candidiasis, the increased mortality from such infections, and the emergence of antifungal resistance to *C. albicans* increases the need for novel and more effective antifungal agents [3].

Bovine colostrum, a natural product, has received increased attention. Colostrum is a nutrient-rich lacteal secretion produced by female mammals immediately after parturition. It is a very complex biological fluid, containing high concentrations of immune, growth and tissue repair factors, and has significant amounts of components that act as natural antimicrobial agents [4].



This research investigated the effect of four natural products, including branded bovine colostrum, on the adherence of metabolically labeled *C. albicans* cells to saliva-coated hydroxyapatite bead - a tooth surface model. This information will provide an evidence base for colostrum as a preventative/treatment of *Candida* infection.

## Theory

Colonization of the oral cavity by *C. albicans* involves cells adhering to oral surfaces. If the cells adhere to host cells, host cell proteins or microbial competitors (co-aggregation), the extent of clearance by the host will be prevented or reduced. Since most surfaces in the oral cavity are bathed in saliva, yeast cells binding to salivary proteins adsorbed to oral surfaces is of vital significance in colonization and the progression to infection [1,5].



Infection in the oral cavity by *C. albicans*, presenting as white patches on the tongue [6].

There is sequence homology between many naturally-occurring and enzymatically-generated components of bovine and human colostrum, which confer various putative biological effects. The high levels of bioactive components of colostrum indicate that it has potential as a dietary supplement in human clinical nutrition and in treating *Candida*-associated disease [7]. Colostrum has already displayed effective inhibition of a range of pathogenic microorganisms and is currently being used for its nutraceutical qualities, based on historical evidence [8]. This research may lead to future therapeutic intervention using colostrum-based formulations that could prevent *C. albicans* adhering to the tooth surface.

## Methodology

Human salivary components were adsorbed to hydroxyapatite (HA) beads; additional binding sites on the beads were blocked with BSA. *C. albicans* cells were radio-labelled with [<sup>35</sup>S] methionine (20μCi) and added to 20 mg of saliva-coated HA beads and the desired concentrations of test solutions. The mixture was incubated with end-over-end mixing. The liquid containing unattached cells was aspirated and the HA beads were washed three times. Remaining radioactivity in the HA beads was then counted using liquid scintillation.

Four compounds were tested: two 'Advanced Protein Systems' bovine colostrums (A20 and A25); '100% Colostrum' bovine colostrum (COL); and a positive control (U2). The means of data from triplicate runs were analyzed by ANOVA.

## Results and Discussion

Radioactivity counts (as a proportion of total input radiation in the original cell sample) for the different concentrations of the four products and a treatment without a test compound (X1,X2) are shown in Figures 1-4. Assuming all cells take up the same amount of radio-label, residual radioactivity is proportional to cell adherence to the HA beads.

Within each replicate, there were significant differences ( $P < 0.001$ ) between the compounds tested at the 5% significance level. The 5% error bars for Least Significant Differences (LSD) represent statistical differences between groups. Statistically significant differences are indicated by zero overlap between error bars.

Both 0.5% w/v A20 and A25 consistently inhibited adherence compared to the control (X1); lower concentrations promoted adherence.

The positive control (U2) also inhibited adherence at nearly all concentrations for most replicates, compared with the control (X2).

'100% Colostrum' (COL) had variable dose response, and no statistical difference between adherence levels was seen for any of its concentrations.

The anomaly (Figure 3) where COL had very high levels of radioactivity, and therefore adherence, may be attributed to a prolonged incubation and mixing period.

## Conclusion

Two of the bovine colostrums tested effectively inhibited adherence at some concentrations, and could have potential in human clinical nutrition, in particular for treating *Candida*-associated infection.

## Acknowledgments

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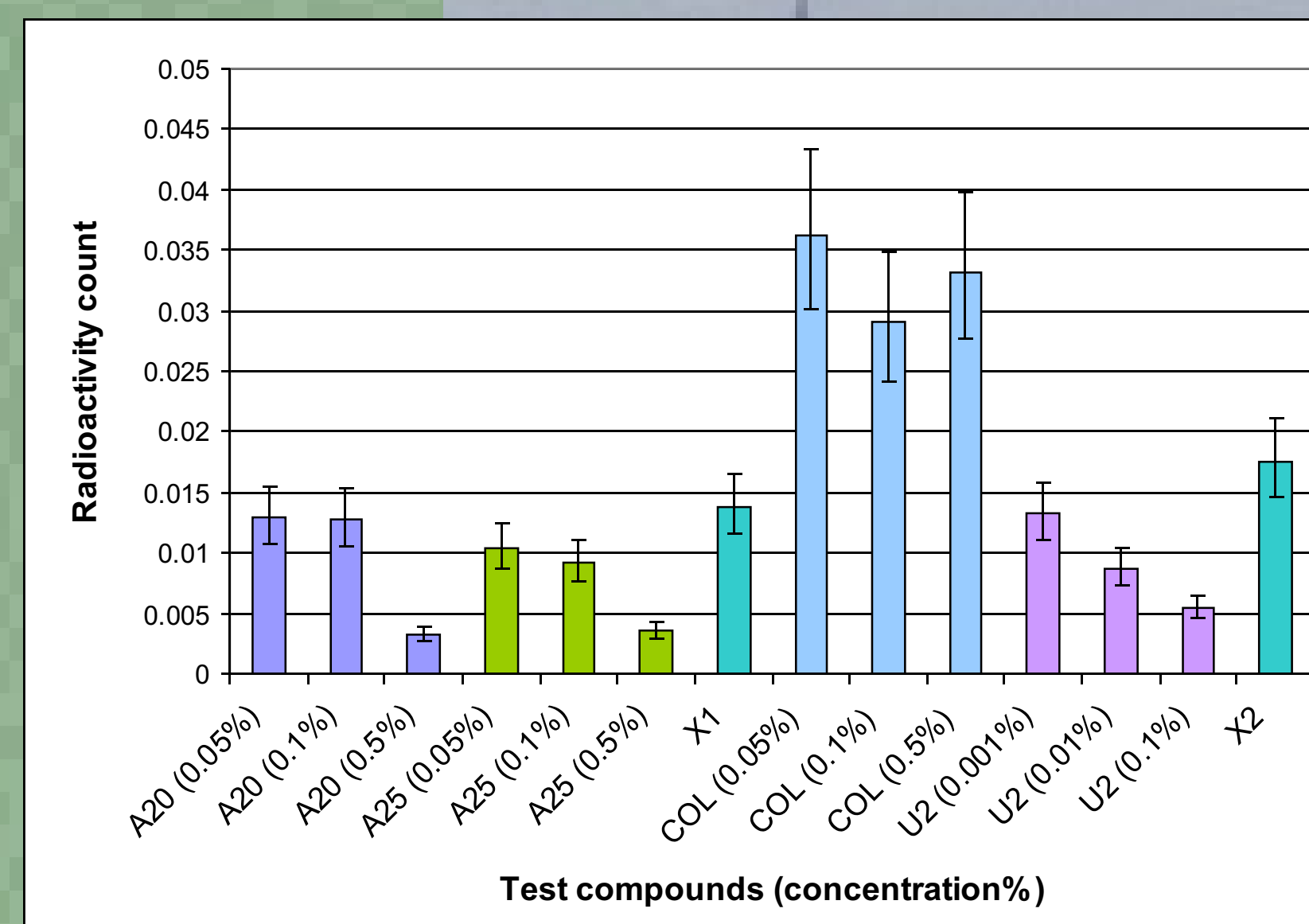


Figure 1: (Replicate One) Radioactivity counts for test compounds at varying concentrations.

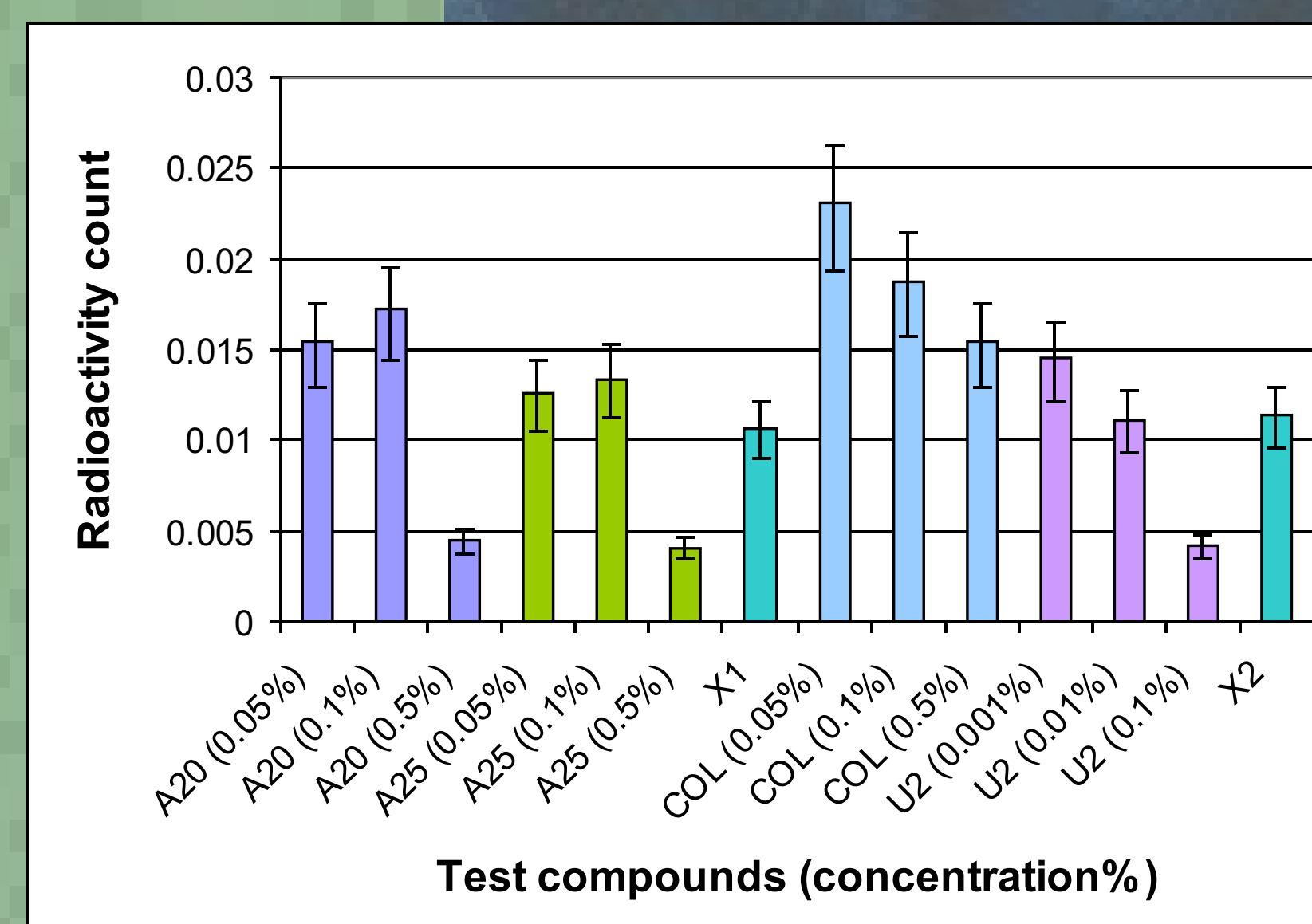


Figure 2: (Replicate Two) Radioactivity counts for test compounds at varying concentrations.

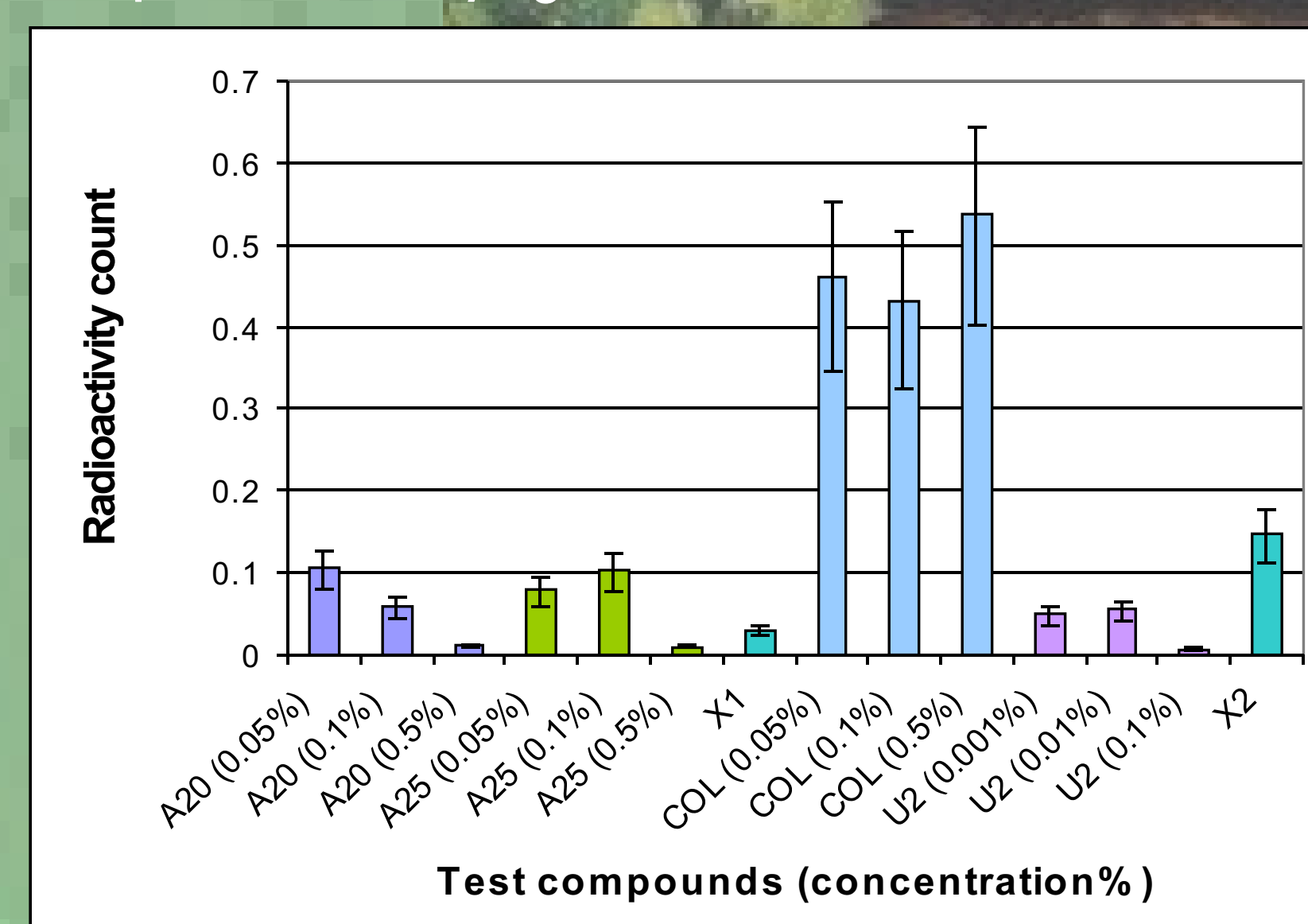


Figure 3: (Replicate Three) Radioactivity counts for test compounds at varying concentrations.

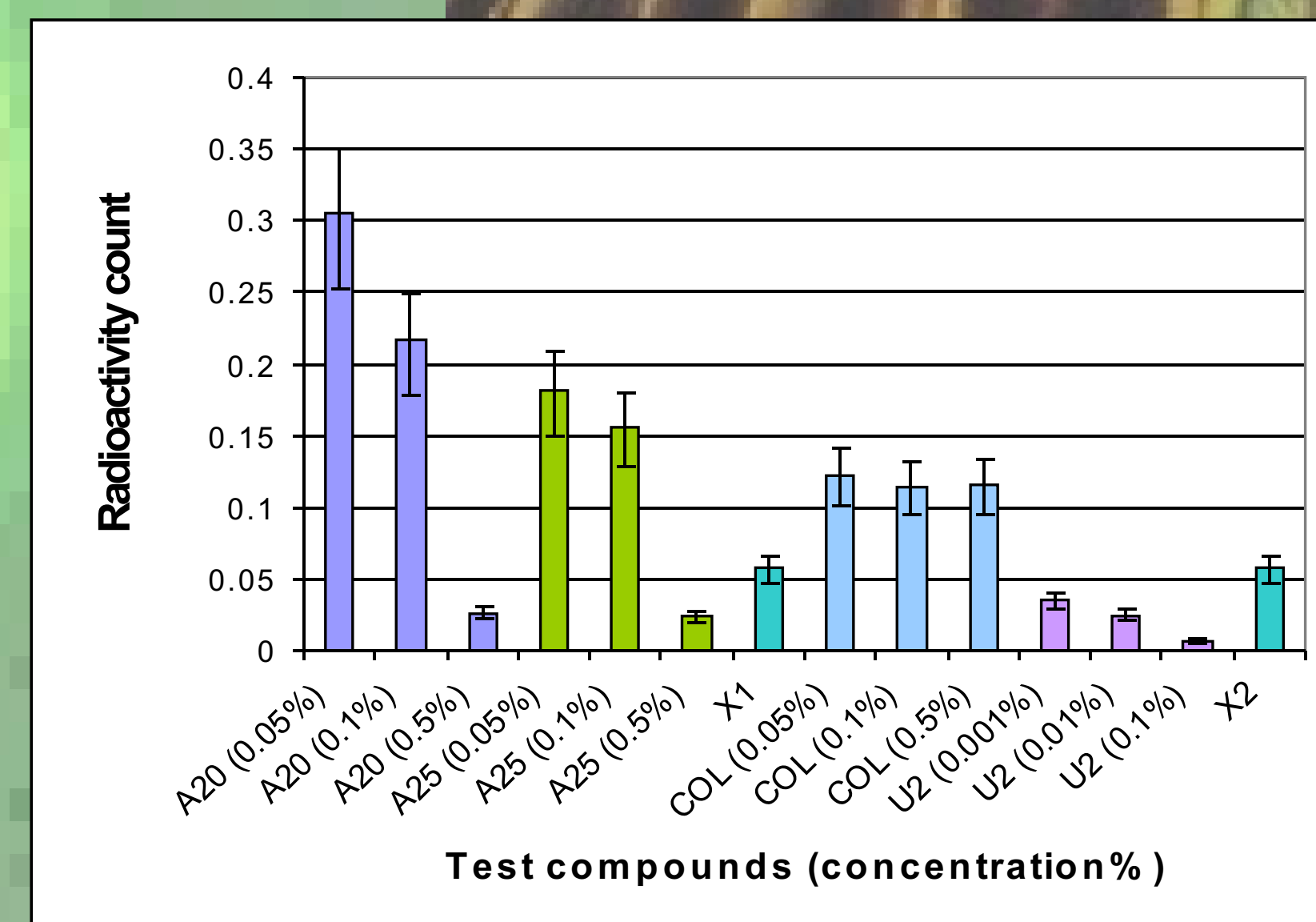


Figure 4: (Replicate Four) Radioactivity counts for test compounds at varying concentrations.