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# ORAL CAVITY, AFT, MATHEMATICAL MODEL, BIOFILM, MICROORGANISMS, DYNAMIC MODEL

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**Abstract**

. The process of antiplaque in the oral cavity (AFT), i.e. the accumulation of microorganisms and the formation of biofilm in the oral cavity, is of great importance in the fields of dentistry and oral hygiene. This article presents the key literature and online resources needed to develop a mathematical model of the process of having AFT in the oral cavity. This model helps us understand the convergence of microorganisms, the formation of biofilm and their dynamics.

**Keywords**: Oral cavity, AFT, mathematical model, biofilm, microorganisms, dynamic model.

## Introduction

The process of antiplaque in the oral cavity (AFT), i.e. the accumulation of microorganisms and the formation of biofilm in the oral cavity, is of great importance in the fields of dentistry and oral hygiene. Creating a mathematical model of this process is necessary in order to understand its dynamics and to effectively develop preventive measures. In this article, we present the main literature and Internet resources needed to develop a mathematical model of the process of AFT in the oral cavity.

## LITERATURE REVIEW

 **Marsh P.D. (2006).** "Dental plaque as a biofilm and a microbial community – implications for health and disease," Journal of Oral Biosciences. This article describes how microbial communities in the oral cavity are formed, transition to a biofilm state, and how they change with hygiene.

 **Kolenbrander PE et al. (2010).** "Bacterial interactions and successions during plaque development," Periodontology, 2000. The gradual proliferation and interaction of bacteria in the development of AFT is important for modeling.

- Biofilm is not just a collection of bacteria, it is their coordinated, multi-layered system.

- The formation of AFT depends on the interaction of the body, hygiene and bacteria.
  - **Dawes, C. (1983).** "A Mathematical Model of Salivary Clearance of Sugar from the Oral Cavity," Caries Research. This paper uses simple ODE (ordinary differential equation) models to calculate metabolism and bacterial growth in the oral cavity.
  - **Wimpenny JWT, Colasanti R. (1997).** “A unifying hypothesis for the structure of microbial biofilms based on cellular automaton models” FEMS Microbiology Ecology. Biofilm modellashtirishda discrete yondashuvlarni ko‘rsatadi (katakli modellar).

- ODE models represent the growth of planktonic bacteria as well as their purification by the flow of saliva.
- Cellular Automata, on the other hand, takes into account bacterial colony size growth and changes in size.

## RESEARCH METHODOLOGY

Creating a mathematical model of the process of AFT in the oral cavity can help to understand the dynamics of microorganism assembly and biofilm formation. The above literature and Internet sources provide the theoretical framework necessary for modeling this process. In the future, by applying these models in clinical practice, it will be possible to develop effective preventive measures in the areas of oral hygiene and dentistry.

## ANALYSIS AND RESULTS

**A model of the process of AFT formation in the oral cavity — Python code:**

**Python**

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```
import numpy as np
import matplotlib.pyplot as plt
# Time Options
time_days = np.linspace(0, 10, 100) #10 day simulation
SD = time_days[1] - time_days[0]
# Model Options
growth_rate = 0.4# Bacterial growth rate (day−1)
cleaning_efficiency = 0.2# Cleaning speed with improved oral hygiene and saliva effect
initial_plaque = 0.1# Initial AFT amount (in relative units)
# AFT (plak) massivini yaratamiz
plaque = np.zeros_like(time_days)
plaque[0] = initial_plaque
# Simulation
for t in range(1, len(time_days)):
   dP = (growth_rate * plate[t-1]) * (1 - plate[t-1]) - cleaning_efficiency * plate[t-1]
   plate[t] = plate[t-1] + dP * dt
# Natijani chizish
plt.figure(figsize=(10, 5))
plt.plot(time_days, plaque, label='AFT (Plak) darajasi')
```

```
plt.xlabel('Vaqt (kun)')
plt.ylabel('AFT rate (relative)')
plt.title('Mathematical model of the process of AFT formation in the oral cavity')
plt.legend()
plt.grid(True)
plt.tight_layout()
plt.show()
```

**Model izohi:**

- In this model, bacteria thrive in a condominium environment (logistic growth).
- Certain part is lost due to the influence of saliva and hygiene.
- In the long run, the AFT rate will shift to a state of equilibrium (refinement and growth equalize).

**References:**


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