**Thermal treatments**

List all the thermal treatments needed, the type of heat exchangers and the mode of use (i.e. co-current vs counter current).

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| **HEAT EXCHANGERS** |
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|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Steps | Heat exchangers | Type | Mode |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |

 |

Determine the time of pasteurization to decrease of **5D** the initial amount of microorganisms. Assume as reference pathogen the vegetative cells of *Escherichia coli* (D(70°C) = 2 s; Z = 5°C). In case of sterilization processes, the target is the reduction of 12D of the spore of *Clostridium botulinum* (D(121) = 0.2 min; Z = 10°C).

Report here below all the calculation and the final result:

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| **MICROBIAL REDUCTION** |
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Determine the loss of thiamine (D(120°C) = 9000 s, Z = 25°C):

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| **THIAMINE LOSS** |
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Assuming that the initial pectinase activity is 10 mmol of pectin per minute per kg of produt, determine the final activity after the thermal processes. (D(80°C) = 10 min, e Z = 10°C):

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| --- |
| **ENZYME DENATURATION** |
|  |