

# “PROCESS DESIGNING AND OPTIMIZATION OF FORMALDEHYDE (HCHO) MANUFACTURING PROCESS BY USING ‘ASPEN HYSYS’ SIMULATION SOFTWARE”

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## ABSTRACT

This project focuses on the process design and optimization of formaldehyde (HCHO) production through the application of Aspen HYSYS simulation software. The study aims to enhance the efficiency and yield of HCHO production by analyzing various process parameters. Through rigorous simulation and optimization techniques, this research explores optimal conditions, reactor configurations, and catalyst selection to maximize the production of high-quality formaldehyde while minimizing energy consumption and environmental impact. The findings highlight the potential for improved process designs to meet industrial demands for HCHO with increased efficiency and sustainability.

The abstract summarizes the process of formaldehyde production using Aspen HYSYS. The study explores the utilization of Aspen HYSYS, a process simulation software, to model and optimize the formaldehyde production process. Key parameters such as reaction kinetics, feed composition, and operating conditions are analyzed to enhance the efficiency and yield of formaldehyde. The study aims to provide insights into the potential of Aspen HYSYS as a tool for designing and optimizing formaldehyde production processes, contributing to the advancement of chemical engineering and industrial applications.

## INTRODUCTION: -

- PREPARATION OF PFD AND P&ID
- PREPARATION EQUIPMENT LIST AND LINE LIST
- LINE SIZING CALCULATIONS
- PUMP HYDRAULICS CALCULATIONS
- STORAGE TANK CALCULATIONS
- SAFETY VALVE CALCULATIONS
- IMPROVE EFFICIENCY USING SIMULATION

PFD AND P&ID

A Process Flow Diagram (PFD) illustrates the general flow of a process, showing major equipment and key control points. A Piping and Instrumentation Diagram (P&ID) provides more detail, indicating piping, valves, instrumentation, and other components.

For formaldehyde production, a PFD might outline the steps for methanol oxidation to formaldehyde synthesis. Meanwhile, a P&ID would show specific equipment like reactors, pumps, valves, and instruments, along with details on piping connections and control loops. Detailed PFDs and P&IDs for formaldehyde plants would be proprietary to the specific engineering design of each facility, considering factors like reaction conditions, safety features, and process optimization.

#### Equipment List and Line List

An equipment list typically refers to a detailed inventory of the physical assets or machinery used in a particular context, such as a project, facility, or organization. It provides information about each piece of equipment, including its name, description, specifications, and often its status or location.

#### Line Sizing and Equipment Sizing

Line sizing calculation depends on various factors such as fluid properties, flowrate, pressure drop, and pipe material. It is also important to know that how much amount Quantity is transfer from one equipment to another equipment

Equipment sizing calculations are specific to the type of equipment, such as pumps, compressors, or heat exchangers. Each type has its own set of parameters to consider, like flow rate, pressure, temperature, and efficiency.

#### Optimization of Process & Simulation

Optimization and simulation of formaldehyde production typically involve mathematical modelling and computational techniques to improve processes and resource utilization.

#### Objectives

Aspen HYSYS Model:

Create an accurate Aspen HYSYS simulation model that represents the entire formaldehyde production process

Reactor Design:

Optimize the design of the reactors used in the process to maximize formaldehyde yield Minimizing energy consumption to reduce the cost of overall project

Catalyst Selection:

select the most suitable one for the formaldehyde Synthesis process

Energy Efficiency:

Improve energy efficiency in the production process by optimizing heat integration and heat exchanger design

Environmental Impact:

Assess and reduce the environmental impact of formaldehyde production

Product Purity Optimize:

product separation and purification processes to achieve the desired formaldehyde purity

#### Result & Conclusion:

We perform a simulation of Formaldehyde plant by using Aspen Hysis software.

Stream	Methanol	Air	Mixed feed	Reactor exit	Absorber outlet	HCHO solution
<b>Component</b>	<b>Mass %</b>	<b>Mass%</b>	<b>Mass %</b>	<b>Mass %</b>	<b>Mass %</b>	<b>Mass %</b>
<b>Methanol</b>	<b>100</b>	<b>....</b>	<b>9.29</b>	<b>0.09</b>	<b>....</b>	<b>0.44</b>
<b>Oxygen</b>	<b>....</b>	<b>23.05</b>	<b>20.91</b>	<b>15.81</b>	<b>17.1</b>	<b>....</b>
<b>Water</b>	<b>....</b>	<b>1.09</b>	<b>0.99</b>	<b>6.42</b>	<b>6.70</b>	<b>65.56</b>
<b>Formaldehyde</b>	<b>....</b>	<b>....</b>	<b>....</b>	<b>7.76</b>	<b>....</b>	<b>37.00</b>
<b>Total</b>						<b>100</b>

### REFERENCES: -

Book Reference:

Title: "Chemical Process Simulation and the Aspen HYSYS Software" Authors: Michael E. Hanyak Jr., Mark A. Pelesko

General Reference:

Aspen Technology's official documentation for Aspen HYSYS. Check their guide and tutorials for specific information on formaldehyde production simulations.

Paper Reference:

For academic papers, you may want to explore databases like IEEEExplore, ScienceDirect, or the American Institute of Chemical Engineers (AIChE) Journal for papers related to formaldehyde production using Aspen hysis.