**DEsigning A CHEMICAL production PLANT MANAGEMENT SYSTEM USING MYSQL**

Author: Vidya Vijay

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# **Requirement Analysis and Definition**

The objective of this project is to design and implement a database for a chemical production plant using MySQL, aiming to gain practical expertise in different stages of plant operation.

## **Scope of Database**

The database is designed for a chemical manufacturing plant for monitoring and scheduling production processes, managing and tracking raw material and product inventory, customer order processing and order status tracking and payment transactions.

The database will be used by executives, production managers, plant operators, and quality assurance personnel and inventory managers. The goal of the database is to streamline various operations in the production plant, increase productivity and help in effective decision-making by managing and analyzing the data effectively.

## **Business Rules**

* Raw materials are used in the production process to manufacture chemical products.
* Each raw material has a unique ID, name, price, and is supplied by exactly one supplier.
* Each raw material may be used in multiple production batches to produce different products.
* Suppliers provide raw materials to the organization. A supplier can supply many raw materials.
* Each supplier has a unique ID, name, address, country, and contact.
* Chemical products are manufactured in production batches through various production runs.
* Each production batch has a unique ID, plant, shift, batch number, and is associated with raw materials.
* Productions are carried out in different plants and shifts. An employee can work in multiple shifts during production.
* Each employee working in the production department has a unique ID, name, designation, email, and contact.
* Products are manufactured in production plants and ordered by customers.
* Each product has a unique ID, name, and quantity.
* A product may appear in many different orders and an order can contain multiple products.
* Each order has a unique ID, date, status, and is associated with a customer.
* Orders can have different statuses like pending, processing, shipped, or delivered.
* An order can have zero or more associated payments.
* Each payment has a unique ID, amount, due date, status, and is associated with an order.
* Payments can have statuses like paid or pending.
* Customers place orders for chemical products and make payments.
* Each customer has a unique ID, name, address, country, and email.
* A customer can place multiple orders.

# **Conceptual Design Model**

## **Entity Relationship Diagram (ERD)**

A diagram of a company

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Figure 1 depicts an Entity-Relationship Diagram (ERD) using Chen's Notation, illustrating entities, attributes, relationships, and cardinalities.

# **Data Model Mapping**

In the following relational table, the M:N relationships between Raw Material and Production tables, as well as between Product and Order tables, have been transformed into 1:M relationships using the linking tables Product\_Material and Order\_Details, respectively.

## **Relational Tables**

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Figure 2 depicts the Relational Tables that display entities, attributes, and foreign key relations.

**Raw\_Material Table:**

RawMaterial\_ID (Primary Key): Unique identifier for each raw material.

RawMaterial\_Name: Name of the raw material.

RawMaterial\_Price: Unit Price of the raw material.

Supplier\_ID (Foreign Key): References the ID of the supplier providing the raw material.

**Supplier Table:**

Supplier\_ID (Primary Key): Unique identifier for each supplier.

Supplier\_Name: Name of the supplier.

Supplier\_Address: Address of the supplier.

Supplier\_Country: Country where the supplier is located.

Supplier\_Contact: Contact details of the supplier.

**Product\_Material Table:**

Raw\_Material\_ID (Foreign Key): References the ID of the raw material.

Prod\_ID (Foreign Key): References the ID of the production batch.

QtyUsed: Quantity of the raw material used for the product in kg.

**Production Table:**

Prod\_ID (Primary Key): Unique identifier for each production batch.

Prod\_Plant: Plant location where the production is taking place.

Prod\_Shift: Shift during which the production occurs.

Prod\_Batch: Batch number of the production process.

Product\_ID (Foreign Key): References the ID of the product produced.

Prod\_Qty: Quantity of product manufactured in each batch in kg.

Employee\_ID (Foreign Key): References the ID of the employee in the shift.

**Employee Table:**

Emp\_ID (Primary Key): Unique identifier for each employee.

Emp\_Name: Name of the employee.

Emp\_Designation: Job title or designation of the employee.

Emp\_Email: Email address of the employee.

Emp\_Contact: Contact information of the employee.

**Product Table:**

Product\_ID (Primary Key): Unique identifier for each product.

Product\_Name: Name of the product.

Product\_Quantity: Quantity of the product available in tons.

**Order\_Details Table:**

Order\_ID (Foreign Key): References the ID of the order.

Product\_ID (Foreign Key): References the ID of the product ordered.

OrderQty: Quantity of the product ordered in boxes.

OrderPrice: Total amount of the order.

**Orders Table:**

Order\_ID (Primary Key): Unique identifier for each order.

Order\_Date: Date when the order was placed.

Order\_Status: Status of the order (e.g., pending, processing, shipped).

Cust\_ID (Foreign Key): References the ID of the customer who placed the order.

**Customer Table:**

Cust\_ID (Primary Key): Unique identifier for each customer.

Cust\_Name: Name of the customer.

Cust\_Address: Address of the customer.

Cust\_Country: Country where the customer is located.

Cust\_Email: Email address of the customer.

Cust\_Contact: Contact details of the customer.

**Payment Table:**

Payment\_ID (Primary Key): Unique identifier for each payment transaction.

Payment\_Amt: Amount of the payment.

Payment\_DueDate: Date when the payment is due.

Payment\_Status: Status of the payment (e.g., pending, paid).

Order\_ID (Foreign Key): References the ID of the order associated with the payment.

## **Functional Dependencies**

The functional dependencies for each table are determined as follows.

**1. Raw\_Material**

RawMaterial\_ID 🡪, RawMaterial\_Name, RawMaterial\_Price, Supplier\_ID (FK)

**2. Supplier**

Supplier\_ID 🡪 Supplier\_Name, Supplier\_Address, Supplier\_Country, Supplier\_Contact

**3. Product\_Material**

(Prod\_ID, RawMaterial\_ID) 🡪 QtyUsed

Prod\_ID 🡪 RawMaterial\_ID

**4. Production**

Prod\_ID 🡪 Prod\_Plant, Prod\_Shift, Prod\_Batch, Product\_ID (FK), Prod\_Qty, Emp\_ID (FK)

**5. Employee**

Emp\_ID 🡪 Emp\_Name, Emp\_Designation, Emp\_Email, Emp\_Contact

**6. Product**

Product\_ID 🡪 Product\_Name, Product\_Qty

**7. Order\_Details**

(Order\_ID, Product\_ID) 🡪 OrderQty, OrderPrice

Order\_ID 🡪 Product\_ID

**8. Orders**

Order\_ID 🡪 Order\_Date, Order\_Status, Cust\_ID (FK)

**9. Customers**

Cust\_ID 🡪 Cust\_Name, Cust\_Address, Cust\_Country, Cust\_Email, Cust\_Contact

**10. Payments**

Payment\_ID 🡪 Payment\_Amt, Payment\_DueDate, Payment\_Status, Order\_ID (FK)

## **Normalization**

All tables in the database meet the criteria for the Second Normal Form (2NF), as no partial dependencies exist in the database schema. Each table has been normalized without any dependency anomalies present. All non-prime attributes are fully dependent on the primary key across all the tables. Thus, data integrity is ensured and data redundancy is minimized.

# **DB Implementation and Operation:**

The MySQL database management system (DBMS) has been employed to implement the database schema into an operational database.

## **Data Definition Language (DDL)**

**Database:** productionplant

The DDL for all the tables in the productionplant database are as follows:

**Raw\_Material**

[CREATE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) [TABLE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) `productionplant`.`raw\_material` (`RawMaterial\_ID` VARCHAR(4) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `RawMaterial\_Name` VARCHAR(15) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `RawMaterial\_Price` DECIMAL(4,2) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Supplier\_ID` VARCHAR(3) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , PRIMARY KEY (`RawMaterial\_ID`)) ENGINE = InnoDB;

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Table 1: Raw\_Material

**Supplier**

[CREATE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) [TABLE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) `productionplant`.`supplier` (`Supplier\_ID` VARCHAR(3) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Supplier\_Name` VARCHAR(23) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Supplier\_Address` VARCHAR(27) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Supplier\_Country` VARCHAR(25) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Supplier\_Contact` VARCHAR(12) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , PRIMARY KEY (`Supplier\_ID`)) ENGINE = InnoDB;

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Table 2: Supplier

**Product\_Material**

[CREATE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) [TABLE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) `productionplant`.`product\_material` (`RawMaterial\_ID` VARCHAR(15) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Prod\_ID` VARCHAR(15) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `QtyUsed` INT(25) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL ) ENGINE = InnoDB;

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Table 3: Product\_Material

**Employee**

[CREATE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) [TABLE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) `productionplant`.`employee` (`Emp\_ID` INT(3) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL AUTO\_INCREMENT , `Emp\_Name` VARCHAR(13) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Emp\_Designation` VARCHAR(20) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Emp\_Email` VARCHAR(25) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Emp\_Contact` VARCHAR(12) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , PRIMARY KEY (`Emp\_ID`)) ENGINE = InnoDB;

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Table 4: Employee

**Production**

[CREATE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) [TABLE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) `productionplant`.`production` (`Prod\_ID` VARCHAR(3) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Prod\_Plant` VARCHAR(7) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Prod\_Shift` VARCHAR(9) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Prod\_Batch` VARCHAR(15) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Product\_ID` VARCHAR(4) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Prod\_Qty` INT(10) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Emp\_ID` INT(3) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , PRIMARY KEY (`Prod\_ID`)) ENGINE = InnoDB;

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Table 5: Production

**Product**

[CREATE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) [TABLE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) `productionplant`.`product` (`Product\_ID` VARCHAR(4) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Product\_Name` INT(20) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Product\_Qty` INT(3) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , PRIMARY KEY (`Product\_ID`)) ENGINE = InnoDB;

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Table 6: Product

**Orders**

[CREATE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) [TABLE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) `productionplant`.`orders` (`Order\_ID` INT(4) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL AUTO\_INCREMENT , `Order\_Date` VARCHAR(10) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Order\_Status` VARCHAR(10) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Cust\_ID` VARCHAR(3) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , PRIMARY KEY (`Order\_ID`)) ENGINE = InnoDB;

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Table 7: Orders

**Order\_Details**

[CREATE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) [TABLE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) `productionplant`.`order\_details` (`Order\_ID` INT(4) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL, `Product\_ID` VARCHAR(10) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `OrderQty` INT(10) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `OrderPrice` INT(10) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL) ENGINE = InnoDB;

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Table 8: Order\_Details

**Payment**

[CREATE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) [TABLE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) `productionplant`.`payment` (`Payment\_ID` INT(4) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL AUTO\_INCREMENT , `Payment\_Amt` DECIMAL(10,2) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Payment\_DueDate` VARCHAR(10) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Payment\_Status` VARCHAR(3) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Order\_ID` INT(4) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , PRIMARY KEY (`Payment\_ID`)) ENGINE = InnoDB;

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Table 9: Payment

**Customer**

[CREATE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) [TABLE](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/create-table.html) `productionplant`.`customer` (`Cust\_ID` VARCHAR(3) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL ,`Cust\_Name` VARCHAR(18) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Cust\_Address` VARCHAR(25) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Cust\_Country` VARCHAR(15) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , `Cust\_Email` VARCHAR(22) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL ,`Cust\_Contact` VARCHAR(12) [NOT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/logical-operators.html%23operator_not) NULL , PRIMARY KEY (`Cust\_ID `)) ENGINE = InnoDB;

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Table 10: Customer

## **Tables with Records**

**Raw\_Material**

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Table 11: Raw\_Material table with records

**Supplier**

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Table 12: Supplier table with records

**Product\_material**

**A screenshot of a computer

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Table 13: Product\_Material table with records

**Production**

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Table 14: Production table with records

**Employee**

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Table 15: Employee table with records

**Product**

**A screenshot of a product list

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Table 16: Product table with records

**Order\_details**

A screenshot of a table

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Table 17: Order\_Details table with records

**Orders**

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Table 18: Orders table with records

**Customer**

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Table 19: Customer table with records

**Payment**

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Table 20: Payment table with records

## **SQL Queries and Results**

1. List all production batches along with the associated raw materials:

[SELECT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/select.html) production.Prod\_ID, production.Prod\_Plant, production.Prod\_Shift, production.Prod\_Batch, product\_material.RawMaterial\_ID, raw\_material.RawMaterial\_Name FROM Production JOIN product\_material ON production.Prod\_ID = product\_material.PROD\_ID JOIN raw\_material ON product\_material.RawMaterial\_ID = raw\_material.RawMaterial\_ID;

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Table 21: Result showing production batches along with the associated raw materials

2. Find the total payment for each order:

[SELECT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/select.html) Order\_ID, [SUM](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/aggregate-functions.html%23function_sum)(Payment\_Amt) AS TotalPayment FROM Payment GROUP BY Order\_ID;

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Table 22: Result showing total payment of each order

3. List the products ordered along with their order quantities and prices:

[SELECT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/select.html) product.Product\_Name,order\_details.Order\_ID, order\_details.OrderQty, order\_details.OrderPrice FROM order\_details JOIN Product ON order\_details.Product\_ID = product.Product\_ID;

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Table 23: Result showing the list of products ordered along with their order quantities and prices

4. Show the customer names and their order status:

[SELECT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/select.html) customer.Cust\_ID, customer.Cust\_Name, orders.Order\_ID, orders.Order\_Status FROM customer JOIN orders ON customer.Cust\_ID = orders.Cust\_ID;

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Table 24: Result showing the customer names and their order status

5. Find total amount paid by each customer

[SELECT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/select.html) orders.Cust\_ID, [SUM](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/aggregate-functions.html%23function_sum)(payment.Payment\_Amt) AS Total FROM Orders JOIN Payment ON orders.Order\_ID = payment.Order\_ID GROUP BY Cust\_ID;

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Table 25: Result showing total amount paid by each customer

6. Show all delivered orders:

[SELECT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/select.html) Order\_ID, Order\_Status FROM `orders` WHERE Order\_Status = 'Delivered';

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Table 26: Result showing all delivered orders

7. Show the details of product using the most expensive raw material

[SELECT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/select.html) product.Product\_ID, product.Product\_Name, product.Product\_Qty, raw\_material.RawMaterial\_ID, raw\_material.RawMaterial\_Name, raw\_material.RawMaterial\_Price FROM product JOIN production ON production.Product\_ID = product.Product\_ID JOIN product\_material ON product\_material.Prod\_ID = production.Prod\_ID JOIN raw\_material ON product\_material.RawMaterial\_ID = raw\_material.RawMaterial\_ID WHERE raw\_material.RawMaterial\_Price = ([SELECT](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/select.html) [MAX](http://localhost/phpmyadmin/url.php?url=https://dev.mysql.com/doc/refman/8.0/en/aggregate-functions.html%23function_max)(raw\_material.RawMaterial\_Price) FROM raw\_material);

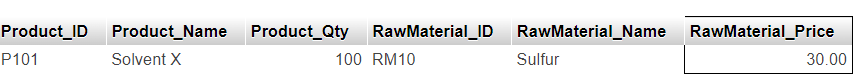


Table 27: Result showing details of product using the most expensive raw material

# **Conclusion**

In conclusion, the database management system for a chemical production plant plays a pivotal role in organizing data and facilitating efficient management of production activities and sales operations involving raw materials, products, orders, customers, and payments. It plays a crucial role in identifying the relationships between various operations and facilitates the coordination of activities, ensuring smooth operation and effective decision-making.

The database is designed by adhering to the normalization principles and ensured that it is in 2NF form, thus ensuring data integrity and minimizing data redundancy, thereby improving operational efficiency. Production managers and plant supervisors can make use of this database to make informed decisions, enhancing productivity and efficiency.

Overall, from inventory and production management to order processing, payments transactions, and customer relationship management, the database management system helps in optimizing operations, improving customer satisfaction, and driving business growth.