

# Scientific investigation into the manufacture of paint essay sample



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Introduction: PPG Industries is a leader in its markets; is a streamlined, efficient manufacturer; and operates on the leading edge of new technologies and solutions. In this assignment I will be comparing the process of paint with the industry and in the laboratory.

Process of paint

In the industry

Making paint involves mixing the pigment with resin, solvents, and other additives to form a paste. This is normally done as the first step.

In industrial used paint it usually then routed into a sand mill. Next it is placed in to a large cylinder where it grind the pigment particles, this process makes it smaller so and dispersing them through the mixture.

Paste - In this process the pigment manufactures sends the bags of the fine grain pigments to paint plants. Next the pigment is premixed with resin. Finally one or more solvent and additives is added to form a paste.

Dispersing the pigment - the paints is routed into a sand mill, the particles of sand or silica to grind the pigment particles. The sand mill makes them smaller. Dispersing them through the mixture. Finally the mixture is filtered so that the sand particles are removed.

Thining the paste - It this process the produced is thinned to produced the final product. The paste is transferred to the large kettles, which is agitated with the proper amount of solvent.

Canning the paint - In This process the final paint product is pumped into the caning room. Where a machine places the lids onto the filled cans, and other presses the lids to seal them. Next the bailometer is then cut and shaped the handles; this is before they are hooked into the holes in the cans.

In the laboratory

Separate the coloured solids from the water filtration

Set up Buchner funnel

Filter paper and Buchner flask

Connect the Buchner flask to the water pump and turn on the water supply.

Pour liquid into the Buchner funnel.

Coloured solid behind should be left behind

Remove any remaining water from your solid.

Scrape solid into a small beaker using a spatula.

Measure about 10cm<sup>3</sup> of propanone in a measuring cylinder.

Pour the propanone into the beaker and stir the mixture with a stirring rod.

Put a new piece of filter paper in the Buchner funnel.

Filter the mixture

Transfer the solid to a mortar.

Grind it carefully with a pestle

Transfer it to a yogurt pot. Add just enough linseed oil to make a thick paint.

Comparing Industrial process to laboratory process

The difference between making pain the lab and in the industry is that making paint in the lab requires more labour work then in the industry, this

is because in the industry machines are used to make the paint. Another

difference is that the amount of paint made differs from each other as in the <https://assignbuster.com/scientific-investigation-into-the-manufacture-of-paint-essay-sample/>

lab only a small amount of paint is made where as in the industry large quality are made. Also the use of paint can sometime differ from each other as in the lab the paint is mostly made for scientific purposes where as in the industry it is made to be sold to the consumer in order to make a profit.

### Equipments

#### A laboratory scale

A laboratory scale is used to measure out substances for example chemicals; the maximum weight they can handle is not that high as they don't require it to be that height. Laboratory scales measure grams too four decimal place, but they only handle up to 100 grams. Laboratory scale is small, because you only need enough to do an experiment. Plus laboratories generally don't have the facilities to produce things in bulk.

#### An Industrial scale

An industrial scale is a large scale which is used to measure considerable amounts of products which are going to be sold. Industrial scale are accurate for large amounts of materials as they measure masses up to 2, 000 pound, the scales only go to the nearest pound, which makes in precise when used in the industries.

#### Difference between an industrial and laboratory scale

Laboratory scales are smaller than industrial scales this is because lab scale are used for small amount of materials, as for industrial scales they are larger as they are used for large and bulky materials. Laboratory scales can only handle up to 100 grams, where as industrial scales can take up to 2, 000 pounds of weight. A laboratory scale and an industrial scale both are

used for the same reason, but they can only handle a certain amount of weight, which makes them specific to their role. Sand mill ( Industry)

A sand mill is a piece of industrial equipment designed to grind a given material into very small particles of roughly equal size. Sand mill is used in the production of making paint by put the pigment with resin solvents and additives in to the sand mill until it forms a paste. Stirring rod and Fliter paper (labaotory)

A stirring rod is a piece of laboratory equipment used to mix chemicals and liquids for laboratory purposes. They are usually made of solid glass. Filter paper is a paper that lets liquid through but prevents soils form passing though. A fitter paper is used to separate fine solids form liquids. Comparing Industrial equipment to laboratory equipment

In the industry a sand mill is used to mix the chemicals together and make the pigment particles smaller which turns it in to a paste. This is also done in the lab but instead a stirring rod is used to mix the chemicals together and a filter papers is used to separate the soils form the liquids this turns it in to a paste. The industrial equipment is better because they require less labour work, which would help to keep the cost of the paint to a minimum. Also it takes less time to make as a machine is faster than a human. Although the equipments used in the lab are more environmentally friendly than using a machine because they do not require electricity or fuel. Accuracy and precision

In a laboratory

A measurement is accurate if it correctly reflects the size of the thing that is being measured.

Precise means the extent to which a given set of measurements of the same sample agree with their mean.

To improve the accuracy of the of the paint in the experiment we should add in a binder in to the experiment, the binder would make the paint stick to the surface, in the experiment I didn't use a binder and I found that not all of the paint stuck to the paper, so by using a binder the quality of the paint will be much better.

In order to make the method more precise, a pipette should be used instead of a measuring cylinder because a measuring cylinder has to be read by its meniscus which can cause human error if the person doesn't know this, also it is not precise. Where as a pipette allow user to measure a volume of solution extremely accurately and then add it so something else.

In the industry

The calibration of the equipment is checked before the process, which ensures precision and accuracy because your will be making sure that the scale for example are placed at zero so the measurement of the materials will be accurate and precise.

Using industrial scales ensures precision and accuracy because they can be used for bulk materials, so they can handle more weight which means that

the result would be accurate and precise as the scales are suited to their needs.

### Comparing Laboratory with industry

The difference between accuracy and precision in a lab and the industry is that in the lab is that human errors can occur which can affect the accuracy and precision of the procedure, where as in the industry errors can occur due to the machine. Although they are both quite similar in insuring accuracy and precision as it requires checking equipment before using it, using better equipments / machines.

### Scientific principle

#### Testing paint in the laboratory

- For each paint, a specific quantity is measured, using identical application methods. The area able to be covered by the paint is measured, in addition to its ability to cover the primed sheetrock behind it.
- Spatter is tested by measuring paint's tendency to spray off of the roller.
- To evaluate stain resistance, two coats of each paint are painted on a wall. One batch of stains was left for 5 minutes, and the other set for an hour before removal with all purpose cleaner.
- To evaluate paint's likelihood to fade over time, samples were placed in a UV accelerated weathering machine and then compared to non-weathered samples.

## Testing paint in the industry

- Colour is checked by an experienced observer and by spectral analysis to see if it matches a standard desired color.
- Resistance of the color to fading caused by the elements is determined by exposing a portion of a painted surface to an arc light and comparing the amount of fading to a painted surface that was not so exposed.
- The paint's hiding power is measured by painting it over a black surface and a white surface.
- Adhesion is tested by making a crosshatch, calibrated to 2 millimeters, on a dried paint surface.
- Scrubbability is tested by a machine that rubs a soapy brush over the paint's surface.

## Testing paint (comparing lab with industry)

The difference between testing paint in the lab with the industry is that in a lab a person tests the pain where as in the industry machines are used to test the paints. Also in the industry a lot of paint is tested at once where as in the lab only a one or two is tested, this is because in the lab a person is doing the testing which takes more time then a machine doing it.

## Animal Testing

Paint is tested on animals; this is because it ensures that paint is not harmful to humans when they are in contact with them. Different chemical in the paint are tested in animals to ensure that adding additional chemical to



improve the quality of paint without harming humans. Also to find out if people whom have illness like asthma will be affected when in contact with paint, and If so they can inform people my having this information on the label of the paint product.

Animal testing (comparing lab with industry)

The difference between animal testing in a lab and the industry is that, it is only done in the lab; this is because the industry is not the suitable environment for testing animals. So in order for the industry to get the data need the lab does the test and then informs the peoples in the industry with the data, this data is then used in the production of paint.

Quality control

The ingredients and the manufacturing process undergoes stringent test. The finished product is checked, this is to insure that it is of a high quality. The inspections on the finished paint are for density, fineness of grain, dispersion and viscosity. Bleed resistance is studied by paint being applied to a surface.

Paint's aesthetic components is checked as, the color is checked by an spectral analysis to see if it matches a standard desired color. A portion of a painted surface is exposed to an arc light to test for resistance of the color to fading caused by the elements.

An object is painted over a black surface and a white surface which is used to measure paint's hiding power. The amount of reflected light given off a painted surface is used to measure gloss. To meature the paint's functional gaulities entails scratching a coat of pain. To test if the paint is good, a piece <https://assignbuster.com/scientific-investigation-into-the-manufacture-of-paint-essay-sample/>

of tap is applied to the crosshatch, and then it is pulled off to see if the surface remains. Fire retardancy is checked by burning the paint and determining its weight loss.

Quality control (comparing lab with industry)

Quality control in a lab and the industry is done in the same way, the only difference is that in a lab one person checks for quality control where as in the industry there are different people to check each part of the quality control.

Quality Assurance

Quality assurance is the process of verifying or determining whether products or services meet or exceed customer expectations

Quality is a constant goal, maintained by rigorous, continuous testing and sampling from source through to delivery. There approach is to product quality, which goes further than raw materials. Quality management systems cover product and service, and stretch from trading desk in London to all around the world. These systems are audited regularly by external companies in maintaining their accreditation.

Steps for Quality Assurance Process:

- Test previous articles
- Plan to improve
- Design to include improvements and requirements
- Manufacture with improvements
- Review new item and improvements
- Test new item

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PDCA is an effective method for monitoring quality assurance because it analyzes existing conditions and methods used to provide the product or service customers. Quality assurance helps to determine whether the steps used to provide the product or service are appropriate for the time and conditions.

Quality assurance (comparing lab with industry)

Quality assurance in a lab and the industry is done in the same way, the only difference is that in a lab one person checks for quality assurance where as in the industry there are different people to check each part of the quality assurance.

Health & safety requirements

In the industry

PPG's goal is to prevent injuries and illnesses through the implementation of effective safety and health programs. PPG's focus is on continuous workplace safety improvement through management leadership and employee involvement. PPG's risk reduction efforts include:

Top management, active leadership, involvement, and accountability at all levels and at all locations. Effective, functioning EHS Leadership Teams develop and implement safety processes customized to the specific risks associated with their operations. •Significant employee accountability and involvement in facility EHS Leadership teams, behavioural based safety processes, ergonomics teams, training, and a variety of other safety focus teams. •Comprehensive employee communication and training for risk awareness and safe work practices. •Established clear definition of global  
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safety requirements and strategies to reduce risk. •Comprehensive reporting, investigation, analysis, and communication of incidents and near miss events through a global reporting system •Implementation of a global corrective action tracking system. •Comprehensive hazard recognition and control processes at all locations. •Tracking of metrics that centre on upstream risk identification as well as downstream results to improve reduction efforts.

### In the laboratory

Health and safety in a Laboratory is done by minimizing exposure to risk. Also it is about protecting people from mishaps. When doing an experiment which involves substance which is hazardous, a small quantity should be used at a time, if it contains harmful fumes it should be used in a fume cupboard.

### HSE inspectors

HSE is a public body in the United Kingdom. HSE provide its employees with good and safe conditions of work, this means having effective management arrangements that ensure the well being of staff, which minimises the impacts to individuals and business from ill health and health injury. Workers have the right to work in a place where risks to their health and safety are properly controlled.

### HSE inspections (comparing lab with industry)

HSE in a lab and the industry is done in the same way, the only difference is that is that only one person comes to inspect the lab, where as in the industry more than one person is need to inspect it, this is because in the

industry is much bigger than a lab and there are more specialist equipments used then in lab.

## Regulations

### Health & Safety laws in the industry

PPG complies with applicable laws and regulations in the countries where PPG operates. Where laws and regulations regarding hazard communication have not been established, PPG follows international practices. Water-based paints

are an all-round performance; they are good from a health and environmental perspective. Solvent-based paints require users a degree of caution to avoid risks relating to potential health hazards. PPG evaluates each of its products for hazards and communicates any determined hazards through warnings which are compliant with the laws and regulations of which the product is manufactured, as well as the jurisdiction into which the product will be distributed or offered for sale.

### Health and safety in a laboratory

Health and safety in a laboratory was set up to help health and safety executive to minimise the risk to people's health and safety at work. The work ranges from helping to control hazards to assisting the management of the occupation health of workers. Controlling hazards – this aims to eliminate hazards altogether, this means ensuring they are properly controlled. This is important to human health and to ensure the health of business. Improving Health – by improving the health of the workforce, this will improve the health of the business.

Good Lab Practice.

Good lab practice is a set of principles which provide a framework which laboratory studies are planned, performed monitored, recorded, reported, and also archived and reported.

The Good lab principles include:

- Organization and personnel— management responsibilities, study personnel responsibilities, sponsor responsibilities, principle investigation responsibilities, and study director responsibilities.
- Quality assurance program- quality assurance personnel
- Facilities- facilities for test and reference items, test system facilities
- Equipments, reagents and materials
- Test systems- biological, physical /chemical
- Test and reference items
- Standard operating procedures
- Performance of study – study plan, conduct of study
- Reporting of results
- Storage of record and reports.

Good lab practice is not carried out in the industry.

Risk assessment in the industry

A risk assessment is an examination of factors that can be about risks. In a workplace, owners of a business legally are required to assess the risks of injury and of ill health affecting an employee. A risk assessment should make sure that enough perceptions are implementing in order to prevent harm

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coming to an employee. It also helps to dispense ill health and accident which can have serious affect on business, ruin lives and damage business output, risk assessments make the workplace a safer environment for employees. It is important that a risk assessment is done, if it is not taken place employees, customers and the organisation will be in danger.

Employer must insure that they look at all work activities that can cause harm in order to decide whether they are doing enough to meet the legal obligations. Risk Management in the laboratory Risk management is to do with analysing what type of risk a person may face in work environment and how we can avoid it or deal with the risk. Essentially, the process identifies any type of situation that could result in damage to any resource within the possession of the company. It is an organisational program which is a successful program; in order for this process to be successful it requires the commitment and cooperation of all. Staffs need to recognise the fundamental importance of health and safety risk management. The process of risk management takes place in four different steps.

1. First step is to reduce any possibility of any accident, this is called hazard identification. This step involves identifying the workplace or anything that can cause injury.

2. Next is the second step which involves the assessment of risk of the hazards which has been identified. In this step information is collected and making decisions take place.

3. Effective risk management is the third step which is to maintain system and establish it. This step gives the opportunity for the regular evaluation

which means that procedures are reviews in order for the risk management to be efficient

4. The final step is the review the process, which involves examining the control measures, this makes sure that the risks are eliminated and if not eliminated there are reduced. It checks that the process is working effectively.

## COSHH

This is a law which requires employers to control substances that are hazardous to health; workers can prevent or reduce workers exposure to hazardous substances by finding out what the health hazards are, providing control measures to reduce harm to health, deciding how to prevent harm to health, planning for emergencies, providing information instruction and training for employees and others, keeping all control measures in good working order.

The COSHH regulations help protect people in the work place against risks form hazardous substances. These substances may be used directly in work or may arise from work activities. The risk depends on a number of factors which are the hazard presented by the substance, how it is used, how exposure is controlled, the degree and extent of exposure. Prevention of exposure to hazardous substances is done by: •finding out what the health hazards are

- deciding how to prevent harm to health
- providing control measures to reduce harm to health
- keeping all control measures in good working order

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- providing information, instruction and training for employees and others
- providing monitoring and health surveillance in appropriate cases
- Planning for emergencies

The Regulations require employers to:

- assess the risks to health and safety
- decide what precautions are needed to prevent ill health •prevent or control exposure
- make sure that the control measures are used and maintained •monitor exposure and carry out health surveillance if appropriate •Ensure that all employees are properly informed, trained and supervised. COSH (comparing lab with industry)

Cosh is carried out in the lab and industry in the same way as each other, the rules used to monitor cosh are the same for the lab and in the industry.

Byproducts and waste regulations in the industry

A regulation is put in place which is concerning the emission of volatile organic compounds. The regulation permits each liter of paint to contain no more than 250 grams of solvent. Paint manufacturers can replace the solvents with pigment, fillers, or other solids inherent to the basic paint formula. This method produces thicker paints that are harder to apply, and it is not yet known if such paints are long lasting. A large paint manufacturer will have an in-house wastewater treatment facility that treats all liquids generated on-site, even storm water run-off. The facility is monitored 24 hours a day. The liquid portion of the waste is treated on-site to the standards of the local publicly owned wastewater treatment facility; it can be used to make low-quality paint.

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### Waste regulations in the labatory

Environmental regulatory burdens are inappropriately placed on many academic, commercial, and government laboratories when regulations designed to address large-scale industrial operations are applied to laboratories. Research, development, instructional, and service laboratories generate a broad range of small quantities of hazardous wastes, but are forced to individually manage each type of waste with the same rigor applied to those who create large amounts of relatively few wastes. By applying an industrial regulatory scheme to laboratories, unintended, ineffective, and inappropriate burdens are placed on these facilities. Environmental impact on the environment.

### PPG's environmental process

Air program is a program which evaluates equipment and process that reduce emissions, and provide environment benefits. Water programs are a program which relays on high quality of water in sufficient quantity to produce produces. They carefully review and manage how water is obtained, treated, used and discharged for operation.

Waste programs are a program which focuses on the use of raw materials and product yields to minimize the generation of waste. Environmental risk management is a program which incorporates risk management concepts into business activities.

### PPG global Emissions

Each greenhouse gas differs in its ability to absorb heat in the atmosphere. This graph shows the progress toward the goals to reduce global emissions.

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It shows CO<sub>2</sub> produced against the year, from looking at the graph you can see the Co<sub>2</sub> produced has decreases every year.

Environmental impacts for lab and industry Volatile organic compounds are the most important environmental impact from paints and coatings. The emission may be captured before release to the atmosphere. In the presence of nitrogen oxides induced VOC oxidation produces ozone as a by-product. Ozone, a highly reactive form of oxygen, is a health risk at very low concentrations, and is the ultimate risk factor associated with VOC emissions. Paint can cause presence of toxic solid materials, which can cause immediate effects of VOCs; solids persist, and can create problems long after the coating is applied. When VOC's react with oxygen, they can form 'bad' ozone in the presence of sunlight. This is a contributory factor to the greenhouse effect and a cause of global warming.

An environmental management system in the industry An environmental management system ensures those governmental agencies and public or private businesses can limit their negative impact on the environment while continuing to run efficiently. It is built on a structure of planning processes, applying principles, monitoring outcomes, and correcting operations. It is designed to improve business operations and efficiently reduce environmental impact Environmental management system in the Laboratory The Environmental Laboratory Section operates a full-service environmental lab that tests and assesses water, air, soil, hazardous materials, and biological samples. Water quality and biological monitoring of surface waters is an important section function. Quality environmental testing services are provided to a variety of customers in a cost-effective manner.

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Its purpose is to be a politically neutral, cost-effective, market-driven organization that provides the highest value and highest quality environmental testing, monitoring, assessment, and information services to benefit both citizens and the natural environment.

#### Disposal of waste

When disposing of unwanted chemicals the local conditions and environmental regulations must be observed. Some chemical and reagents must require flushing down drainage system, rather than disposing it. When carrying out drainage disposal care must be taken while doing the procedure. Chemicals that are more than required or old stocks must be identified to a staff of senior status and if they decide it is not required it should be disposed off correctly. Empty containers that are used to store hazardous chemical require specific disposal which means that they are not to be placed into a yellow bag. All containers that are used for storing chemical waste should be undamaged and sealed. Liquid waste containers should only be filled to 70-80% of capacity, if there is more this could cause spillage occurring from an overfilled container. All materials must be clearly identified preventing the mixing of waste which could cause a reaction. Information of the components in the container must be provided.

#### Disposal of waste (comparing lab with industry)

The way in which waste is disposed of is very similar to the lab and industry, the difference can be that the liquid waste container in the lab is much smaller than the one in the industry as it is 10x the size, this is because in the industry more industrial waste is produced. Also the yellow bag which is used for hazardous chemical is also much larger in the industry, apart from <https://assignbuster.com/scientific-investigation-into-the-manufacture-of-paint-essay-sample/>

these two factors the way in which waster is disposed for is the same in each situation.

### Conclusion

From comparing the Laboratory with the industry I have come to a conclusion that they are not very different from each other when it comes to the production of paint. I have noticed that size in which things are done is very different to each other as in the industry paint is manufactured to a larger scale then in the lab. The difference between the lab and in the industry is the lab requires more labour work then in the industry, this is because in the industry machines are used. Also the use of paint can sometime differ from each other as in the lab the paint is mostly made for scientific purposes where as in the industry it is made to be sold to the consumer in order to make a profit. The industrial equipment is better because they require less labour work, which would help to keep the cost of the paint to a minimum. Also it takes less time to make as a machine is faster than a human. Although the equipments used in the lab are more environmentally friendly than using a machine because they do not require electricity or fuel. In the lab human errors can occur which can affect the accuracy and precision of the procedure, where as in the industry errors can occur due to the machine.

Testing paint in the industry is better as paint is tested at once where as in the lab only a one or two is tested, this is because in the lab a person is doing the testing which takes more time then a machine doing it.

Overall the industry is better way of making pain as more paint can be made at once, there are machines to do the job which means labour charge is kept to a minimum which can lead to a bigger profit and reduce the selling cost. However the machines can have a negative impact on the environment as it can causes pollutions, this can make the production of paint in the lab seem better but it would require more time and labour which would mean increasing the cost of paint.