

TITLE**CHEMICAL COMPOSITION FOR ANTI-CORROSION MINERAL PAPER.****DESCRIPTION**

This invention relates to a Chemical Composition of the Anti-Corrosion Mineral Paper, comprising of mineral powders, anti-static agents, UV agents, a mixture of synergistic corrosion inhibitors and a special binding agent.

DESCRIPTION OF PRIOR ART

It has long been the object of applicant's research to provide an alternative to the pulp-based standard corrosion Inhibitor paper, as it does not use trees, copious amounts of water, chlorine, acids, or petroleum in its creation. Mineral Paper with Corrosion Inhibition, UV Resistant and Anti-Static Properties seem to be a good alternative to replace the Pulp-based Anti-Corrosion Paper.

Primarily mineral/stone papers are made from calcium carbonate, silica powder and polypropylene or polyethylene resin.

US Patent No. 20140135423 A1 discloses a method for manufacturing the green energy paper consisting of a stone powder (limestone powder) a pure white silica powder and a non-toxic resin (polypropylene or polyethylene). This enables the paper to have greater strength, foldability, water resistance and ink absorption when machined into writing paper as opposed to traditional paper.

However, no discourse is included on corrosion inhibition, anti-static and UV Resistant properties in US Patent No.20140135423 A1 with respect of using it the paper as a packaging material for electronic and electrical equipment, or to prevent the degeneration of paper due to harmful UV Rays since it does not contain any corrosion inhibitors and UV Resistant Additives.

The said patent fails to recognize the need for an immediate abatement of corrosion, providing anti-static properties, enhancing UV resistance and the need to introduce Polyvinyl Alcohol (PVA) to enhance its film forming to resist oil, grease and solvents.

Polyvinyl Alcohol (PVA) also enhances the tensile strength, adhesive properties and flexibility of the mineral paper, as well as the high oxygen barrier which is essential for good packaging anti-corrosion paper. In addition to above benefits, the introduction of Polyvinyl Alcohol (PVA) reduces the usage of Polypropylene and Polyethylene Powders/Resins to make it more environmentally friendly as it enhances the biodegradability of the mineral paper.

The applicant's invention is nonobvious even to a person skilled in the art of US Patent No.20140135423.

US Patent No.20120211189 A1 discloses a method for manufacturing recyclable mineral paper, which comprises natural inorganic mineral powders, polypropylene (PP) which comprises a mixture of polylactic acid (PLA) or PP and Polyethylene (PE).

However, the US Patent No.20120211189 A1 does not discuss how inhibition of corrosion is achieved and does not recognize the need to immediately abate corrosion on metallic parts with respect of using mineral paper as packaging material.

The said patent fails to recognize the need for an immediate abatement of corrosion, the provision of UV resistance and the introduction of Polyvinyl Alcohol (PVA).

BACKGROUND OF INVENTION

The production and use of anti-corrosion and packaging paper has a number of adverse effects on the environment which are known collectively as paper pollution. Pulp mills contribute to air, water and land pollution. Pulp and paper is the third largest industrial polluter to air, water, and land in both Canada and the United States, and releases well over 100 million kg of toxic pollution each year. In addition, discarded paper is a major component of many landfill sites, accounting for about 35 percent by weight of municipal solid waste (before recycling). Even paper recycling contributes to pollution due to the sludge produced during de-inking.

Worldwide, the pulp and paper industry is the fifth largest consumer of energy, accounting for four percent of all the world's energy use. The pulp and paper industry uses more water to produce a ton of product than any other industry.

Therefore, great efforts are needed to ensure that the environment is protected during the production, use and recycling/disposal of this enormous volume of material.

It has long been the object of applicant's research to provide an alternative to the pulp-based standard anti-corrosion paper, as it does not use trees, water, chlorine, acids, or petroleum in its creation. It is primarily made from minerals such as calcium carbonate, one of the most common substances on the planet; found in the shells of marine organisms, pearls, and eggshells, or as natural by-products of water and limestone in quarries.

SUMMARY OF THE INVENTION

The present invention has been made in an effort to solve the above-described problems associated with the prior art, to fortify the mineral stone paper with corrosion inhibitors UV Agents, Anti-Static Agent and Special Binder. It employs a combination of synergistic corrosion inhibitors such as Anodic, Cathodic, Adsorption, Volatile Corrosion Inhibitors, Azole compounds, Titanium Dioxide, Zinc Oxide, or Silicone Dioxide as inorganic UV blockers, Anti-Static Agent such as Aromatic Sulfonamide, the Aromatic Sulfonamides may be Ortho, Meta, or Para substituted on the aromatic part thereof, or may be N-substituted on the amide group thereof, Synthetic Polymer Binder such as Polyethylene, Polypropylene powders and Polyvinyl Alcohol (PVA) as special binder.

This invention relates to the chemical composition of anti-corrosion mineral paper comprising pulverized 55-90 wt % of mineral powders including calcium carbonate, calcium silicate, calcium sulfate, barium sulfate, silica powder, chalk powder, dolomite powder, talcum powder, pulverized coal powder, kaolin, mica powder, zinc oxide, pigment, silicon dioxide, bentonite, clay, diatomite, and mixtures thereof, being subjected to calcination or not), anti-static agent, 1-10 wt% UV resistant agent 1-10 wt%, 1-20 wt% of mixture synergistic anti-Corrosion inhibitors which comprises of anodic, cathodic, adsorption, Volatile Corrosion Inhibitors, azole compounds and phosphates and 10-40 wt % of synthetic polymers binder which comprises of polyvinyl alcohol, polyethylene and polypropylene powders.

Another embodiment of the invention is to prevent the anti-corrosion mineral stone paper from degeneration due to UV by adding Titanium Dioxide, Zinc Oxide, or Silicone Dioxide as inorganic UV blockers.

In another embodiment Polyvinyl Alcohol (PVA) is added to the chemical formulation of the anti-corrosion mineral paper to enhance its film forming of the mineral paper which is resistant to oil, grease and solvents. In a further embodiment, Polyvinyl Alcohol (PVA) is added to the chemical composition to reduce the usage of Polypropylene and Polyethylene resin/powders to make it more environmentally friendly through the enhancement of biodegradability of the mineral paper.

The above said invented chemical formulation widens the application of the mineral paper for both industrial and commercial packaging of metallic parts, electrical and electronic or components or devices, not mentioned in US Patent No. 20140135423 A1 and US Patent No. 20120211189 A1

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following descriptions are exemplary embodiments only, and are not intended to limit the scope, applicability or configuration of the invention in any way. Rather, the following

description provides a convenient illustration for implementing exemplary embodiments of the invention. Various changes to the described embodiments may be made in the function and arrangement of the elements described without departing from the scope of the invention as set forth in the appended claims.

According to the aspect of the present invention, it is the object of the invention to provide the chemical composition of the anti-corrosion mineral paper comprising of a mixture of mineral powders, mixture of synergistic corrosion inhibitors, anti-static agent, inorganic UV Inhibitors, polymer-polyvinyl alcohol (PAV) and polypropylene and polyethylene powder or resin.

In an embodiment of the said invention, the mineral powders consist of calcium carbonate, calcium sulfate, calcium silicate, kaolin, barium sulfate, silica, betnonite, mica powder, zinc oxide, chalk powder, silica powder, talcum powder and dolomite powder as fillet for the Mineral Anti-Corrosion Paper.

In another embodiment of said invention a mixture of synergistic corrosion inhibitors are used to enhance the corrosion inhibition properties of the mineral paper. The combination of synergistic corrosion inhibitors such as Anodic, Cathodic, Adsorption, Volatile Corrosion Inhibitors,azole compounds and phosphates are used to enhance the corrosion inhibition of the mineral paper.

Anodic corrosion inhibitors such as Sodium silicate, Sodium Meta silicate, Potassium Silicate, Sodium Hepta Silicate and Hexafluorosilicates, Molybdates, Orthophosphates, and Nitrites corrosion inhibitors are used as synergistic corrosion inhibitors to enhance the corrosion inhibition properties of the mineral paper. The preferred anodic corrosion inhibitor is Sodium Silicate, it is a proven corrosion inhibitor, effective on a variety of metals, including tin, zinc and copper. The preferred anodic corrosion inhibitor is Sodium silicate because it reacts with metal surfaces to form a protective barrier against corrosion. It also increases water pH, another important corrosion control mechanism.

Cathodic corrosion inhibitors such as zinc salts, calcium salts, and magnesium salts are used to reduce the corrosion rate due to retarding cathodic reactions. The preferred Cathodic Corrosion Inhibitor is Calcium Salts due to excellent compatibility in said chemical composition.

Adsorption inhibitors reduce the corrosion rate due to Polarization of the metal via an extremely thin layer of molecules being adsorbed on the surface. Decrease of the affective surface area results in reduction of the corrosion rate. Adsorption inhibitors are substances (mainly organic) capable to form chemisorbed bonds with surface metal atoms. The following compounds are used as adsorption inhibitors Amines ($R-NH_2$); Carboxyls ($R-COOH$); Thiourea (NH_2CSNH_2); Phosphonates ($R-PO_3H_2$); Sodium Benzoate ($C_7H_5NaO_2$). The preferred adsorption corrosion inhibitor is Sodium Benzoate because of its excellent corrosion inhibition properties for steel, zinc, soldered joints, aluminium and its alloys.

Volatile Corrosion Inhibitors inhibits corrosion in enclosed spaces. (package, bags) The Vapour molecules hydrolyse into ions when in contact with moisture, the ions then polarize on the metal surface to form mono-molecular invisible protection film reducing the corrosion rate. The following compounds are used as Volatile corrosion inhibitors (VCI): Cyclohexylamine,, Dicyclohexylamine;

Dicyclohexylammonium nitrite, cyclohexylammonium carbonate, Benzoates Guanidine,, Aminoalcohols, Nitrites. The preferred Volatile Corrosion Inhibitor is Dicyclohexylamine due to its excellent Vapour Pressure. A volatile corrosion inhibitor (VCI) is a chemical substance that is added to the surface of a paper. Metal that is to be protected is covered with this paper, and these chemicals are slowly volatilized and release compounds within a sealed airspace that actively prevents surface corrosion of the metal.

Azole compounds such as Benzotriazole, (1,2,4-triazole, 1H-benzotriazole, benzothiazole, benzimidazole, benzoxazole, 2,2'-biquinoline, nitrone, 2,5-dimercapto-1,3,4-thiadiazole, and 2,9-dimethylphenanthroline, 1H-benzotriazole, 5-methylbenzotriazole, 5-carboxybenzotriazole, 2-alkylbenzothiazole, 2-mercaptobenzothiazole, 2-mercaptobenzothiazolesuccinic acid, be 2-alkylbenzimidazole, 2-(5-aminopentyl) benzoxazole, and 2-mercaptobenzoxazole, 1-phenyl-5-mercapto-1,2,3,4-tetrazole (PMT), Tolytriazole,, Thiazole and derivatives 5-benzylidene-2,4- dioxotetrahydro-1,3-thiazole (BDT); 5-(4'-isopropylbenzylidene)-2,4-dioxotetrahydro-1,3-thiazole (IPBDT); 5-(3'-thenylidene)-2,4-dioxotetrahydro-1,3-thiazole (TDT) and 5-(3',4'- dimethoxybenzylidene)-2,4-dioxotetrahydro-1,3-thiazole (MBDT) are copper corrosion inhibitors . The preferred Azole compound is benzotriazole due to its excellent anti-oxidation inhibition properties for copper and brass. The preferred azole compound used is Benzotriazole due to its excellent anti-oxidation properties for copper.

The phosphate based corrosion inhibitor includes: Polyphosphate , Orthophosphate, Tripolyphosphate and its derivatives, Zinc Orthophosphate, Zinc Phosphate, Zinc Polyphosphate, Zinc Tripolyphosphate, Zinc Hexametaphosphate, Sodium Hexametaphosphate, Sodium Tripolyphosphate, Sodium Phosphate, Sodium Tetrphosphate, Tetrasodium Phosphate, Sodium Septaphosphate. The preferred Polyphosphate is Sodium Polyphosphate because of its excellent corrosion for iron.

In yet another embodiment of the said invention, aromatic sulfonamide such as benzenesulfonamide, N-butyl benzenesulfonamide, o-toluenesulfonamide, p-toluenesulfonamide, N-ethyl-o-toluene sulfonamide, N-ethyl-p-toluenesulfonamide, or mixtures thereof are used as an anti-static agent in the said invention. The preferred aromatic sulfonamide is N-butyl benzenesulfonamide due to its excellent anti-static properties.

In another further embodiment, Titanium Dioxide, Zinc Oxide, or Silicone Dioxide are used as inorganic UV blockers to enhance the UV Resistant property of the said

invention. The preferred UV blocker is Titanium Dioxide due to its excellent UV properties, other advantages include as nontoxicity, chemical stability at high temperature, and permanent stability.

In yet another further embodiment, special binders such as Polyvinyl Alcohol (PVA), Modified- starch, Synthetic polymers or dispersion form Cellulose-derived, water-soluble polymer powder, Calcium aluminate, Monomers of acrylonitrile, Silicious clay material, Natural asphalt mineral, Microcrystalline cellulose powder and Calcium silicate composite powder are used to enhance the tensile strength, adhesive properties and flexibility of the mineral paper, while creating a high oxygen barrier which is essential for good packaging anti-corrosion paper. In addition to above benefits, the introduction of special binders will reduce the usage of Polypropylene and Polyethylene powders to make it more environmentally friendly through the enhancement of biodegradability of the mineral paper. The preferred special binder is Polyvinyl Alcohol due to its excellent biodegradability properties.

The detailed chemical composition of the anti-corrosion mineral paper are herein described:

- 1) In accordance with the invention, the main constituent of the chemical composition consisting of 55-90 wt % 250 to 300 mesh of pulverized mineral powders, the mineral powders used may comprise a single said mineral powder or a combination, such as calcium carbonate, calcium sulfate, calcium silicate, kaolin, barium sulfate, silica, betnonite, mica powder, zinc oxide, chalk powder, silica powder, talcum powder and dolomite powder used as fillet for Mineral Anti-Corrosion Paper are loaded into the powder mixer as shown in figure 1.
- 2) 1-10% wt of anti-static agent consisting of aromatic sulfonamide consisting N-butly benzenesulfonamde, is loaded to the powder mixing mixer to be mixed for 10-15 minutes as shown in figure 2.
- 3) 1-10% wt of UV agent consisting of Titanium Dioxide is then loaded into the powder mixer to be mixed for 10-15 minutes as shown in figure 3.
- 4) 1-20 % wt of a mixture of synergistic corrosion inhibitors consisting Sodium Silicate, Calcium salts, Sodium Benzoate, Dicyclohexylamine, Benzotriazole, and Sodium Polyphosphate are selected and loaded into the powder mixer to be mixed for 10-15minutes as shown in figure 4.
- 5) 10-40% wt of polyethylene and polypropylene powders and special binder consisting of Polyvinyl Alcohol (PVA), are loaded into the powder mixer for 15-30 minutes until all the said chemicals are thoroughly mixed as shown in figure 5.

Examples

The following are the illustrative of various embodiments of the foregoing invention.

Example 1

This example illustrates the chemical composition of the anti-corrosion mineral paper which typically consists of 80 wt % of 250 to 300 mesh of pulverized calcium carbonate, 3 wt% of N-butyl benzenesulfonamide, 2 wt % of Titanium Dioxide, 2 wt % of Sodium Silicate, 2wt% of Calcium salt, 2 wt % of Dicyclohexylamine, 1 wt % of Benzotriazole, 1 wt % of Sodium Polyphosphate, 3 wt % of Polyvinyl Alcohol, 2 wt % of Polyethylene powder, and 2 wt % of Polypropylene powder.

Example 2

This example illustrates the chemical composition of the anti-corrosion mineral paper which typically consists of 60 wt % of 250 to 300 mesh of pulverized calcium carbonate, 5 wt % of talcum powder, 5 wt % calcium silicate, 5 wt % of silica powder, 5 wt % of zinc oxide, 3 wt% of N-butyl benzenesulfonamide, 2 wt % of Titanium Dioxide, 2 wt % of Sodium Silicate, 2 wt% of Calcium Salt, 2 wt % of Dicyclohexylamine, 1 wt % of Benzotriazole, 1 wt % of Sodium Polyphosphate, 3 wt % of Polyvinyl Alcohol, 2 wt % of Polyethylene powder, and 2 wt % of Polypropylene powder.

Example 3

This example illustrates the chemical composition of the anti-corrosion mineral paper which typically consists of 70 wt % of 250 to 300 mesh of pulverized calcium carbonate, 10 wt % of Barium Sulfate, 10 wt % of Calcium Silicate, 10 wt % of Silica Powder, 3 wt% of N-butyl benzenesulfonamide, 2 wt % of Titanium Dioxide, 2 wt % of Sodium Silicate, 2 wt % of Dicyclohexylamine, 1 wt % of Benzotriazole, 1 wt % of Sodium Polyphosphate, 5 wt % of Polyvinyl Alcohol, 2 wt % of Polyethylene powder, and 2 wt % of Polypropylene powder.

Example 4

This example illustrates the chemical composition of the anti-corrosion mineral paper which typically consists of 82 wt % of 250 to 300 mesh of pulverized calcium carbonate, 2 wt% of N-butyl benzenesulfonamide, 2 wt % of Titanium Dioxide, 1 wt % of Sodium Silicate, 2 wt % of Calcium salt, 2 wt % of Dicyclohexylamine, 1 wt % of Benzotriazole, 1 wt % of Sodium Polyphosphate, 3 wt % of Polyvinyl Alcohol, 2 wt % of Polyethylene powder, and 2 wt % of Polypropylene powder

Example 5

This example illustrates the chemical composition of the anti-corrosion mineral paper which typically consists of 55 wt % of 250 to 300 mesh of pulverized calcium carbonate, 4 wt% of N-butyl benzenesulfonamide, 5 wt % of Titanium Dioxide, 10 wt % of Sodium Silicate, 2 wt% of Calcium salt, 2 wt % of Dicyclohexylamine, 2 wt % of Benzotriazole, 5 wt % of Sodium Polyphosphate, 8 wt % of Polyvinyl Alcohol, 5 wt % of Polyethylene powder, and 2 wt % of Polypropylene powder

CLAIMS

- 1) A chemical composition for anti-corrosion mineral paper which comprises 55-90 weight % of pulverized inorganic mineral powders, 1-10 wt % of anti-static agent, 1-10 w % of UV agent, 1-20 wt % of mixture of synergistic corrosion inhibitors, 10-40 wt % of specialty binder.
- 2) A chemical composition for anti-corrosion mineral paper as in claim 1 wherein the inorganic mineral powder consists of calcium carbonate, calcium sulfate, calcium silicate, kaolin, barium sulfate, silica, betnonite, mica powder, zinc oxide, chalk powder, silica powder, talcum powder and dolomite powder as fillet for Mineral Anti-Corrosion Paper.
- 3) A chemical composition for anti-corrosion mineral paper as in claim 1 wherein the anti-static agent is aromatic sulfonamide, the aromatic sulfonamides may be ortho, meta, or para substituted on the aromatic part thereof, or may be N-substituted on the amide group thereof.
- 4) A chemical composition for anti-corrosion mineral paper as in claim 3 wherein the anti-static agent aromatic sulfonamide such as benzenesulfonamide, N-butyl benzenesulfonamide, o-toluenesulfonamide, p-toluenesulfonamide, N-ethyl-o-toluene sulfonamide, N-ethyl-p-toluenesulfonamide, or mixtures thereof are used as an anti-static agent in the said invention.
- 5) A chemical composition for anti-corrosion mineral paper as in claim 1 wherein the UV agent consists of Titanium Dioxide, Zinc Oxide, or Silicone Dioxide.
- 6) A chemical composition for anti-corrosion mineral paper as in claim 1 wherein synergistic corrosion inhibitors consist of Anodic, Cathodic, Adsorption, Volatile Corrosion Inhibitors, azole compounds and phosphates are used to enhance the corrosion inhibition of the mineral paper.

- 7) A chemical composition for anti-corrosion mineral paper as in claim 6 wherein synergistic Anodic corrosion inhibitors consist of Sodium silicate, Sodium Meta silicate, Potassium Silicate, Sodium Hepta Silicate and Hexafluorosilicates, Molybdates, Orthophosphates, and Nitrites corrosion inhibitors are used as synergistic corrosion inhibitors to enhance the corrosion inhibition properties of the mineral paper.
- 8) A chemical composition for anti-corrosion mineral paper as in claim 6 wherein synergistic Cathodic corrosion inhibitors consist of zinc salts, calcium salts and magnesium salts.
- 9) A chemical composition for anti-corrosion mineral paper as in claim 6 wherein synergistic adsorption inhibitors consist of Amines ($R-NH_2$); Carboxyls ($R-COOH$); Thiourea (NH_2CSNH_2); Phosphonates ($R-PO_3H_2$); Sodium Benzoate ($C_7H_5NaO_2$).
- 10) A chemical composition for anti-corrosion mineral paper as in claim 6 wherein Synergistic Volatile Corrosion Inhibitors consist of Cyclohexylamine,, Dicyclohexylamine,, Dicyclohexylammonium nitrite, cyclohexylammonium carbonate, Benzoates Guanidine,, Aminoalcohols and Nitrites.
- 11) A chemical composition for anti-corrosion mineral paper as in claim 6 wherein Synergistic Corrosion Inhibitors consist of Benzotriazole, (1,2,4-triazole, 1H-benzotriazole, benzothiazole, benzimidazole, benzoxazole, 2,2'-biquinoline, nitron, 2,5-dimercapto-1,3,4-thiadiazole, and 2,9-dimethylphenanthroline, 1H-benzotriazole, 5-methylbenzotriazole, 5-carboxybenzotriazole, 2-alkylbenzothiazole, 2-mercaptobenzothiazole, 2-mercaptobenzothiazolesuccinic acid, be 2-alkylbenzimidazole, 2-(5-aminopentyl) benzoxazole, and 2-mercaptobenzoxazole, 1-phenyl-5-mercapto-1,2,3,4-tetrazole (PMT), Tolytriazole,, Thiazole and derivatives 5-benzylidene-2,4- dioxotetrahydro-1,3-thiazole (BDT); 5-(4'-isopropylbenzylidene)-2,4-dioxotetrahydro-1,3-thiazole (IPBDT); 5-(3'-thenylidene)-2,4-dioxotetrahydro-1,3-thiazole (TDT) and 5-(3',4'- dimethoxybenzylidene)-2,4-dioxotetrahydro-1,3-thiazole (MBDT) as copper corrosion inhibitors.
- 12) A chemical composition for anti-corrosion mineral paper as in claim 6 wherein Synergistic Corrosion Inhibitors consist of Polyphosphate , Orthophosphosphate, Tripolyphosphate and its derivatives, Zinc Orthophosphosphate, Zinc Phosphate, Zinc Polyphosphate, Zinc Tripolyphosphate, Zinc Hexametaphosphate, Sodium Hexametaphosphate, Sodium Tripolyphosphate, Sodium Phosphate, Sodium Tetraphosphate, Tetrasodium Phosphate, Sodium Septaphosphate.

- 13) A chemical composition for anti-corrosion mineral paper as in claim 1 wherein the special binders such as Polyvinyl Alcohol (PVA), Modified- starch, Synthetic polymers or dispersion form Cellulose-derived, water-soluble polymer powder, Calcium aluminate, Monomers of acrylonitrile, Silicous clay material, Natural asphalt mineral, Microcrystalline cellulose powder, Calcium silicate composite powder, Polypropylene and Polyethylene powders are used to enhance the tensile strength, adhesive properties and flexibility of the mineral paper.