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(54) **Title:** A NOVEL DUSTLESS CHALK AND PROCESS OF MAKING THE SAME

(57) **Abstract:** The invention relates to a dustless chalk, having cylindrical shape with specified length and diameter. A process of making dustless chalk comprises step of preparing calcium sulphate di-hydrate 20% to 60% and Calcium sulphate hemi- hydrate 30% to 70% mixing with poly hydro compound. The said composition is treated with air removing agent while chalk is made in the known way the said composition is treated with air removing agent maintain uniformity and strength of chalk. Also the said composition is treated with poly-hydro compound to prevent release of dust particle

TITLE

A NOVEL DUSTLESS CHALK AND PROCESS OF MAKING THE SAME

FIELD OF THE INVENTION:

Present invention relates to dustless chalk and process for the preparation of same. More particularly present invention relates to dustless chalk and process for the preparation of same by using the poly-hydro compounds alongwith the other chemically active compounds.

BACKGROUND OF THE INVENTION:

Teachers, students and people giving presentations, commonly use school board chalks. These are tapered in design from one end to another end by 1.5-3.0 mm. On use these chalks soil the hand and leaving loose particles which are released in air during writing. These particles float in the air and enter in human body by inhalation resulting in various respiratory ailments.

PRIOR ART:

In prior art there are no dustless chalks available in the market and the present invention is altogether a new product. The chalks available in the market have the tendency of more soiling of hands. It is typically seen that the existing chalks are not eco-friendly. It is also seen that the chalks available are polluting the environment thereby resulting in various respiratory ailments.

The document CN 101831218 (A) the invention relates to an environment-friendly dustless biochemical chalk and a making method thereof. The environment-friendly dustless biochemical chalk is made of main materials and auxiliary materials, wherein the main materials comprise the following components in parts by weight: 10-20 parts of calcium carbonate, 9-13 parts of castor oil, 6.5-8.5 parts of bean oil, 5-6 parts of coconut oil, 14-16 parts of surfactant, 4.5-5.5 parts of magnesium carbonate and 3.2-3.8 parts of paraffin; and the auxiliary materials comprise the

following components in parts by weight: 25-45 parts of titanium pigment powder, 2-3 parts of glycerol and 0-3 parts of pigment. The obtained dustless biochemical chalk has fine and flexible quality, smooth writing and bright color and is not easily broken, furthermore, the product has clear characters and easy identification no matter the product is dry or wet and is written on a blackboard, a glass or the surface of any substance, and most important of all, no dust occurs in the writing and erasing processes. But these chalks writing on black board cannot be easily erased by dry duster as it contains oily based auxiliary components.

The main component of known chalk is calcium carbonate (CaCCb), a form of limestone. Limestone deposits develop ascoccoliths (minute calcareous plates created by the decomposition of plankton skeletons) accumulate, forming sedimentary layers. Plankton, a tiny marine organism, concentrates the calcium found naturally in seawater from .04 percent to 40 percent, which is then precipitated when the plankton dies.

In the prior art chalk is generally manufactured as follows:-

Once comparatively large chunks of limestone have been quarried, and they are pulverized to meet the demands of the chalk industry. The first step is primary crushing. Various crushers exist, but the principle is the same: all compress the stone with jaws or a cone, or shatter it through impact. Secondary crushing is accomplished by smaller crushers that work at higher speeds, producing pebbles which are then ground and pulverized.

The next phase, wet grinding, washes away impurities. It is used to make the fine grade of limestone necessary to make chalk suitable for writing purposes. Wet grinding is carried out in ball mills—rotating steel drums with steel balls inside that pulverize the chalk until it is very fine.

Gypsum, like limestone, is also quarried and pulverized. The major difference in processing gypsum is that it must be dehydrated to form calcium sulfate, the major component of coloured chalk. This is done in a kettle, a large combustion chamber in which the gypsum is heated to between 244 and 253 degrees Fahrenheit (116-121 degrees Celsius). It is allowed to boil until it has been reduced by twelve to fifteen

percent, at which point its water content will have been reduced from 20.9 percent to between 5 and 6 percent. To further reduce the water, the gypsum is reheated to about 402 degrees Fahrenheit (204 degrees Celsius), at which point it is removed from the kettle. By now, almost all of the water has evaporated, leaving calcium sulfate.

The particles of chalk or calcium sulfate are now conveyed to vibrating screens that sift out the finer material. The ensuing fine chalk is then washed, dried, packed in bags, and shipped to the manufacturer. Upon receiving chalk or calcium sulfate, the chalk factory usually grinds the materials again to render them smooth and uniformly fine.

To make white classroom chalk, the manufacturer adds water to form a thick slurry with the consistency of clay. The slurry is then placed into and extruded from a die—an orifice of the desired long, thin shape. Cut into lengths of approximately 24.43 inches (62 centimeters), the sticks are next placed on a sheet that contains places for five such sticks. The sheet is then placed in an oven, where the chalk cures for four days at 188 degrees Fahrenheit (85 degrees Celsius). After it has cured, the sticks are cut into specified lengths. The chalk so obtained are not dustless chalk and hazardous to health.

In the prior art process there is no feature for making dustless chalk.

OBJECT OF THE PRESENT INVENTION:

Object of the present invention aims at developing dustless chalk and process for the preparation of same.

Yet another object of the present invention is to provide chalks that are user friendly.

Yet another object of the present invention is to provide chalks capable of releasing quantity required for writing/marking only.

Yet another object of the present invention is to eliminate the limitations and drawbacks of the existing chalks by eliminating the soiling of the chalks.

STATEMENT OF INVENTION:

Accordingly invention provides the dustless chalk, having cylindrical shape with specified length and diameter, made of compositions comprising: calcium sulphate di-hydrate 20% to 60% and Calcium sulphate hemi-hydrate 30% to 70% mixed with poly hydro ccrr.pound; the said composition is treated with air removing agent to maintain uniformity and strength of chalk.

Accordingly invention also provides a process of making dustless chalk comprises step of

a. gypsum heated between 100 °C and 150 °C (302 °F) partially dehydrates the mineral by driving off approximately 75% of the water contained in its chemical structure to form calcium sulphate hemi hydrate; .
b. the said calcium sulphate hemi hydrate 30% to 70% of step (a) is mixed with the calcium sulphate di-hydrate 20% to 60%
c. adding the poly-hydro compound to the said mixer of step (b);
d. thoroughly mixing the said mixture of step (c) in a mixing apparatus in the known way;
e. preparing slurry of the said mixture of step (d);
f. adding air-removing agent to the said slurry of step (e);
g. pouring the said slurry material of step (f) in a well prepared mould for partial setting;
h. ejection of chalks by pressing the ejection rods;
i. collection of chalks formed in step (h) in a tray;
j. the drying the said chalks of step (i) in the tray;
k. the packing the said dried chalks of step (j) and ready for dispatch.

DRAWING

The invention is described with figure of the accompanying drawing wherein Figure 1 shows the flow sheet of process of making dustless chalk according to invention.

BRIEF DESCRIPTION OF THE INVENTION:

The invented Dustless Chalk is cylindrical in shape unlike others, which are tapered from one end to another by 1.5 to 2.0 mm. The cylindrical shape has uniform strength through out the length, while in case of tapered shape strength changes across the length as diameter of chalk varies. It increases breakage frequency of chalk in tapered shape, while breaking of chalk gets minimized in cylindrical shape. The Chalk, when used for writing on well-maintained School boards releases only desired quantity for marking the substrate and is erasable with dry piece of cloth. It is formulated in such a way that excess particles, if released due to extra force in writing, fall directly on the ground under gravitational force and do not disperse in the air due to which chalk particles do not enter human body through inhalation resulting in user friendly characteristics

A novel Dustless chalk and process for the preparation of same according to the present invention, uses Calcium sulphate di-hydrate, Calcium sulphate hemi-hydrate, air-removing agents, and Poly-hydro compound in the predefined proportion.

The preferred embodiment of the dustless chalks comprises of the following:

- Present invention contains Calcium sulphate di-hydrate not less than 20% and not more than 60%.
- Presenl invention contains Calcium sulphate hemi-hydrate not less than 30% and not more than 70%.
- Present invention uses air-removing agent to maintain uniformity and strength of chalk.
- Present invention uses Poly-hydro compound to prevent release of dust particles which disperse in air.
- Present invention uses hydrophobic mould release agent, which does not affects the properties of product.

The dustless chalk is having cylindrical shape with specified length and diameter, made of compositions comprising: calcium sulphate di-hydrate 20% to 60% and Calcium sulphdie hemi-hydrate 30% to 70% mixed with poly hydro compound; the

said composition is treated with air removing agent to maintain uniformity and strength of chalk.

Air removing ayent is an additive which displaces entrapped air in powder particles and makes chalks more compact Air removing agent is an additive which displaces entrapped air in powder particles and makes chalks more compact

The process steps:-

Heating gypsum to between 100 °C and 150 °C (302 °F) partially dehydrates the mineral by driving off approximately 75% of the water contained in its chemical structure. The temperature and time needed depend on ambient partial pressure of H_20 . Temperatures as high as 170 °C are used in industrial calcination, but at these temperatures γ-anhydrite begins to form. The reaction for the partial dehydration is:

$$CaS0_4 \cdot 2H_20 + \text{heat} \rightarrow CaS0_4 \cdot ½H_20 + 1½H_20 \text{ (steam)}$$

The partially dehydrated mineral is called calcium sulfate hemihydrate or calcined gypsum

The dehydration (specifically known as calcination) begins at approximately 80 °C (176 °F), although in dry air, some dehydration will take place already at 50 °C. The heat energy delivered to the gypsum at this time (the heat of hydration) tends to go into driving off water (as water vapor) rather than increasing the temperature of the mineral, which rises slowly until the water is gone, then increases more rapidly.

In contrast to most minerals, which when rehydrated simply form liquid or semi-liquid pastes, or remain powdery, calcined gypsum has an unusual property: when mixed with water at normal (ambient) temperatures, it quickly reverts chemically to the preferred dihydrate form, while physically "setting" to form a rigid and relatively strong gypsum crystal lattice:

$$CaSCv ½H_20 + 1½ H_20 \rightarrow CaS0_4 \cdot 2H_20$$

This reaction is exothermic and is responsible for the ease with which gypsum can be cast into various shapes including sheets (for drywall), sticks (for blackboard chalk), and molds (to immobilize broken bones, or for metal casting). Mixed with

polymers, it has been used as a bone repair cement. Small amounts of calcined gypsum are added to earth to create strong structures directly from cast earth, an alternative to adobe (which loses its strength when wet). The conditions of dehydration can be changed to adjust the porosity of the hemihydrate, resulting in the so-called alpha and beta hemihydrates (which are more or less chemically identical).

Referring to figure 1 which is process flow diagram, The gypsum treated as described abc.e to form calcium sulphate hemi hydrate. The said calcium sulphate hemi hydrate 30% to 70% is mixed with the calcium sulphate di -hydrate 20% to 60 %. The poly-hydro compound is added to the to the said mixer of step (b).The mixer of calcium sulphate hemi hydrate and calcium sulphate di hydrate and poly hydro compound thoroughly mixed in a mixing apparatus in the known way. The slurry is made by adding water to the said thoroughly mixed mixture. The air removing agent is added to the said slurry. The said slurry is poured in a well prepared mould for partial setting. The hydrophobic mould release agent is used in the mould. The chalks ejected from the mould by pressing the ejection rods. The chalks ejected from mould are collected in a tray and dried. When fully dried packed and kept ready for dispatch.

Sr. No.	Parameters	Values
1	Odour	Material Shall be free from any uncharacteristic odour.
2	Brightness (%)	Min.92
3	Purity (%)	Min. 96
4	Setting time	3-4 minutes

ADVANTAGES OF THE PRESENT INVENTION:

- It is evident visually during writing test carried out that release of dust particles is less in invented chalks and floating particles are also negligible in comparison to prior art chalks.
- Less soiling of hands in comparison to existing moulded school board chalks

- Controlled release of chalk particles during writing.
- Released particles directly fall on the surface under gravitational force and do not float in the air.

WE CLAIM:-

1. A dustless chalk, having cylindrical shape with specified length and diameter, made of compositions comprising: calcium sulphate di-hydrate 20% to 60% and Calcium sulphate hemi-hydrate 30% to 70% mixed with poly hydro compound; the said composition is treated with air removing agent to maintain uniformity and strength of chalk.
2. A process of making dustless chalk comprises step of
   l. gypsum heated between 100 °C and 150 °C (302 °F) partially dehydrates the mineral by driving off approximately 75% of the water contained in its chemical structure to form calcium sulphate hemi hydrate; .
   m. the said calcium sulphate hemi hydrate 30% to 70% of step (a) is mixed with the calcium sulphate di-hydrate 20% to 60
   n. adding the poly-hydro compound to the said mixer of step (b);
   o. thoroughly mixing the said mixer of step (c) in a mixing apparatus in the known way;
   p. preparing slurry of the said mixer of step (d);
   q. adding air-removing agent to the said slurry of step (e);
   r. pouring the said slurry material of step (f) in a well prepared mould for partial setting;
   s. ejection of chalks by pressing the ejection rods;
   t. collection of chalks formed in step (h) in a tray;
   u. the drying the said chalks of step (i) in the tray;
   v. the packing the said dried chalks of step (j) and ready for dispatch.
3. the process as claimed in claim 2 wherein the temperature and time needed for forming calcium sulphate hemi hydrate depend on ambient partial pressure of H_2O.
4. The process as claimed in claim 2 wherein the hydrophobic mould release agent is used in mould while molding chalks.

CHALK MANUFACTURING PROCESS FLOW CHART

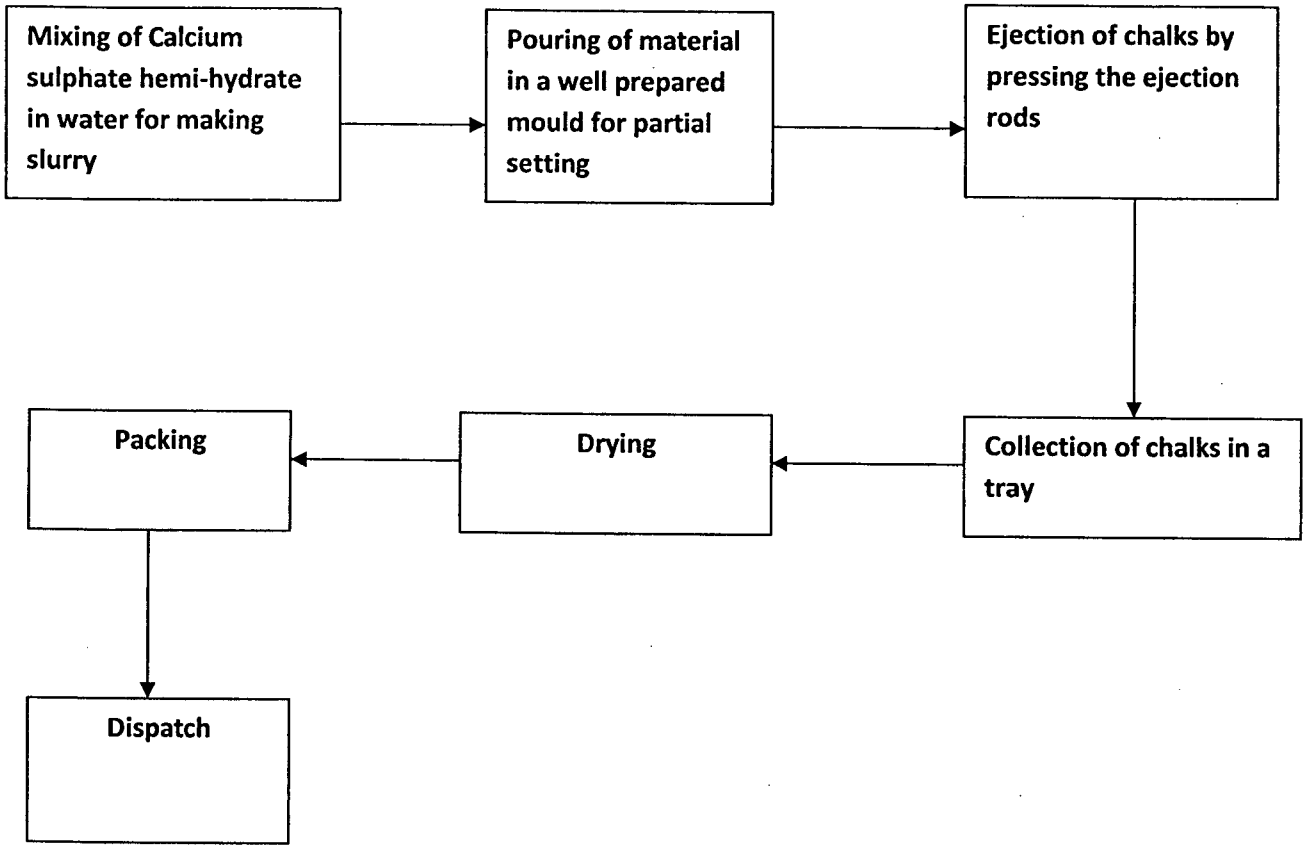

FIGURE 1

INTERNATIONAL SEARCH REPORT

International application No.

PCT / IN 201 1/000334

A. CLASSIFICATION OF SUBJECT MATTER

IPC: ***C09D 13/00*** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C09D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 1203 484 A (HAGOROMO BUNGU KK) 1989-08-16, (abstract WPI) World Patents Index [online], London, U.K.: Derwent Publications, Ltd. [ermittelt am 2011-09-14], Questel/Orbit, Paris, France, DW 198939, AN- 1989-280949 Abstract	1,2
A	CN 1078 686 A (LIFF-I) 24-1 1-1993, (abstract WPI) World Patents Index [online], London, U.K.: Derwent Publications, Ltd. [ermittelt am 2011-09-14], Questel/Orbit, Paris, France, DW 19971 1, AN -1997-109536 Abstract	1, 2

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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19 September 201 1 (19.09.201 1)	27 September 201 1 (27.09.201 1)

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