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An Idealogy of Replacing Arsenic Trioxide by Poultry Feather Meal for the Treatment of Acute Promyelocytic Leukaemia

Sathiyaraj E[1], Saravana Kumar K[1], Kavimaran K[1], Ganesh B[2]*

[1]Final year, Department of Chemical Engineering,
[2]Assistant Professor, Department of Chemical Engineering, Adhiparasakthi Engineering College, Melmaruvathur- 603319, India

Abstract : The ideology of arsenic exposure from poultry feather meal can be used for the treatment of Acute Promyelocytic Leukaemia (APL) is disclosed. In broilers organo-arsenal drugs are widely used for enhancing the growth of chickens. Feathers from these chickens are processed into animal meal products and it is used as an animal feed additive and also as organic fertilizer. Various drugs are injected onto the broilers and one such drug is called as roxarsone(4-Hydroxy-3-nitrophenyl) which is the major reason for accumulation of inorganic arsenic in the feathers of chickens. Arsenic trioxide is a chemotherapy drug which is already in use for treatment for Acute Promyelocytic Leukaemia (APL). Therefore, the feather meal can be directly taken by APL patients which would result in speeding up the death of leukaemic cells and encourages normal blood cells to develop properly.
Keywords : Acute Promyelocytic Leukaemia(APL), roxarsone, feather meal, organo-arsenal drug.

Introduction

Feather meal is a by-product of processing poultry. It is made from poultry feathers by partially grinding them under elevated heat and pressure, and then grinding and drying. Generally, feather meal is used in formulated animal feed and in organic fertilizer.

Arsenic is a chemical element with symbol As and atomic number 33. It occurs in many minerals, usually in the combination with sulphur and metals, but also as a pure elemental crystal.Oxides of arsenic has found immense use in medical fields. For example, in the 1970s, arsenic trioxide which is also called as Trisenox, used in the treatment of typical type of cancer called as Acute Promyelocytic Leukaemia (APL).

Now a days, in this modern world, people get affected by various forms of cancers due to their change in life style and change in their habitats. One such type of cancer is called as Acute Promyelocytic Leukaemia (APL). It is a subtype of Acute Myeloid Leukaemia (AML), a cancer of white blood cells. In APL, there is a normal accumulation of immature granulocytes called promyelocytes.

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The intake of arsenic by humans is injurious to health as continuous intake of arsenic leads to rapid growth of cells in our body which leads to cancer[1]. But it is found that a trace quantity of arsenic trioxide is used as a chemotherapy drug to inhibit the growth of cancer cells in our body. It is used to cure a typical type of cancer called as Acute Promyelocytic Leukaemia (APL).

Arsenic has been considered to be a poison for a long time. Since the 1820s, it has been gradually accepted as a environmental carcinogen for some human malignancies, especially for skin and lung cancers[2]. But in traditional Chinese Medicine, arsenous acid or arsenic trioxide paste is often used to treat tooth marrow disease as a devitalizing agent. It has also been use in some other diseases such as psoriasis, syphilis, and rheumatosis. As the proverb tells " Diamond cuts diamond", it is used in the principle that " using a toxic against another toxic". 2000 years ago, in ancient Greek and Roman times, arsenic was both used as therapeutic agent and poison. In Western Medicine, arsenic was used more recently in the treatment of syphilis and as a tonic in Fowler's solution[2].It is also used in the treatment of trypanosomiasis involving the central nervous system.

Materials and Methods

At first the poultry feather has to be processed to make feather meal. Feather meal is made through a process called rendering. Steam pressure cookers with temperatures over 140 degree Celsius are used to cook and sterilize feathers. This partially hydrolyses the proteins, which denatures them. It is then dried, cooled and ground into a powder for use as a nitrogen source for animal feed or as an organic soil amendment. An analysis of feather meal across the United States also shows a variety of drugs that chickens are exposed to. Antibiotics such as fluoroquinolones which have been banned but are still included in food supply. Other drugs include antihistamines, fungicides, sex harmonenorg estimate and caffeine. The bio-accumulative effects of this variety of pharmaceuticals are of great concern to human health. The feather meal produced by the above process is unfit to consume as animal supplements. Therefore hydrolysis is done to make it as a consumable one. In hydrolysis the disulphide bonds in the keratin are broken and amide bonds are broken to form more digestible smaller proteins, peptides and amino acids. This whole process of preparing feather meal is called thermal pressure hydrolysis.

After preparing the feather meal its constituents are found out and its compositions are noted. It will be rich in nitrogen content. It is already found that the range of arsenic content will be from 45 to 4410 micrograms per kg of broilers. The range of arsenic is determined by the amount of roxarsone injected onto the broilers.

The dosage level of arsenic trioxide varies according to the stages of Acute Promyelocytic Leukaemia (APL)[3]. Mostly arsenic trioxide is given along with tretinoin for treatment of adults.

The treatment course consists of 1 induction and 4 consolidate cycles. In induction cycle 0.15mg/kg of arsenic trioxide is injected into the veins per day until remission of bone marrow and this process should not exceed 60 days[6]. In consolidation cycle 0.15mg/kg of arsenic trioxide is injected onto the veins directly for 1-5 days or weeks 1-4 of an 8 week cycles.

Process Assumption

Here we can notice that the arsenic level in feather meal is close to the dosage content required for the Acute Promyelocytic Leukaemia (APL). Therefore it can be predicted that feather meal can be given to the APL patients orally. As the feather meal has high nutritive and protein value, it can be used to strengthen the body of APL patients.

The roxarsone drug which is injected onto the broilers has to be altered in such a way that the arsenic level in feather meal has to be equal to the required dosage level for the APL patients. Similarly for various dosage levels which are given for various stages of cancer are noted down and the level of roxarsone given to the broilers has to be altered accordingly.

Present Side Effects of Arsenic Trioxide's Dosage

These are the major side effects of arsenic trioxide and most people do not experience all of these mentioned side effects.

- Cough
- Fatigue
- Fever
- Headache
- Rapid heartbeat
- Abdominal pain
- Diarrhoea
- Shortness of breath
- Blurred vision and eye irritation
- Swelling of face, hands and legs
- Joint pain
- Itching
- Anxiety
- Nausea and vomiting
- Shivering and sudden feel of cold

When any of these symptoms are noticed the dosage level and the time of dosage has to be altered according to the kinds of side effects[9].As it is given orally the side effects caused by arsenic on humans will be very less compared to the present existing method (arsenic trioxide which is injected on to the veins in a periodic manner)[10]. Instead of using arsenic trioxide for medication it can be replaced by feather meal as we can easily alter the arsenic content in it. The feather meal which we are going to use it as a replacement of arsenic trioxide in medical field is very cheap compared to the cost of arsenic trioxide.

Future uses of Arsenised Feather Meal in Medical Fields

- Treatment of chronic lymphotic leukaemia
- Treatment of malignant glioma
- Treatment of myelodysplastic syndrome
- Treatment of multiple myeloma
- Treatment of liver cancer
- Treatment of chronic myeloid leukaemia
- Treatment of amyotrophic lateral sclerosis
- Treatment of acute promyeloctic leukaemia

Advantages of this Idealogy

- No side effects are noticed till now.
- The arsenic content in feather meal can be easily altered.
- It is cheap.
- It acts as a nutritive supplement for cancer patients.

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