大幸薬品株式会社

2009 年 9 月

低濃度二酸化塩素ガスの効果に関する研究論文が、医学専門誌 *“International Journal of Medicine and Medical Sciences”* に掲載 ～低濃度二酸化塩素ガス発生器具の配置による学童の欠席率低下を確認～

大幸薬品株式会社（本社：大阪府吹田市内本町三丁目 34 番 14 号、代表取締役社長：柴田 仁、以下 大幸薬品）が発表した研究論文、「学童の欠席に対する極めて低濃度の二酸化塩素ガスの効果(Effect of chlorine dioxide gas of extremely low concentration on absenteeism of schoolchildren)」が、医学専門誌 *“International Journal of Medicine and Medical Sciences”* の 2009 年 7 月号に掲載されました。

今回掲載された論文では、風邪やインフルエンザなどの感染症が流行しやすい冬期(1 月-3 月)の小学校において、学童の累積欠席率(連続 38 授業日間)を比較したところ、低濃度二酸化塩素ガス発生器具(『クレベリン G』)を配置した教室(1.5%)のほうが、配置しなかった教室(4.0%)より有意に低下した($p < 0.00001$)偶然の発見を報告しています。当初は、『クレベリン G』を消臭目的で使用していましたが、事後の分析により、教室での器具の配置の有無で使用期間中の学童の累積欠席率に差が見られたことから発見に至りました。

この研究結果から、閉鎖空間におけるウイルスの飛沫感染などの予防に低濃度の二酸化塩素ガスの使用が有効であることが推測されます。

昨今、新型インフルエンザの感染経路として、学校のほか病院や飛行機など、不特定多数の人々が利用する閉鎖空間での感染が注目を浴びていることから、今後も当社研究所では二酸化塩素の研究を継続し、感染症予防対策についての実験結果の拡充を目指していきます。

※掲載論文（英文）は別添をご参照ください。

【タイトル】
“Effect of chlorine dioxide gas of extremely low concentration on absenteeism of schoolchildren”
(学童の欠席に対する極めて低濃度の二酸化塩素ガスの効果)

●掲載誌について⇒http://www.academicjournals.org/IJMMS/About.htm
●掲載された論文 ⇒http://www.academicjournals.org/IJMMS/PDF/pdf2009/Jul/Ogata%20and%20Shibata.pdf

用語解説

『クレベリン』：

『クレベリン』は、当社が持つ“二酸化塩素特許技術”を活かし製造販売している“衛生管理製品シリーズ”の主力製品です。製品は“空間向け”と“物体向け”の 2 つに分かれ、用途に応じてご使用頂けます。

今回、実験に使用した“空間向け”の『クレベリン G』は、容器内のゲル剤から発生する“二酸化塩素ガス”の働きにより、空間中に存在するウイルス・菌・ニオイを除去します。寝室やリビング等に置くだけで、室内のウイルス除去・除菌・消臭ができる画期的な製品です。内容量 60g と 150g の 2 種類があり、設置場所等に合わせてお選び頂けます。『クレベリン G』は業務用として発売されており、一般向けとして『クレベリン ゲル』が発売されています。

一方、“物体向け”の一般向け製品『クレベリン スプレー』は、身の回りの気になる場所にスプレーしてウイルス・菌・ニオイを除去します。洗面所、トイレ、まな板等のキッチン用品をはじめとした、様々な場所でウイルス除去・除菌・消臭にご使用頂けます。

『クレベリン ゲル 150g』 製品写真

【ご参考】

“二酸化塩素特許技術”により製品化に成功した“衛生管理製品シリーズ”

当社では、「様々なウイルス・菌・ニオイを、ごく低濃度でも除去出来る」という二酸化塩素の働きに着目し、ウイルス除去・除菌・消臭が出来る“衛生管理製品シリーズ”を製造販売しています。

二酸化塩素は「液体やゲルに溶存させた際、その濃度を長期間保持出来ない」という性質のために、流通可能な製品の開発は困難とされてきました。この問題点を、当社が持つ特許技術（特許 第 3110724 号）により解決し、流通出来る製品の開発が可能になりました。

「二酸化塩素の働きで、居住空間に存在する様々なウイルス・菌を除去し、身の回りの“衛生管理”を行う」という新しいアプローチを提唱しているこの事業を、当社では“感染管理事業”と命名しました。現在、『正露丸』や『セイロガン糖衣Ａ』等を製造販売する医薬品事業に続く、第二の柱に育成すべく、研究開発の推進等、積極的な事業展開を行っております。

二酸化塩素の“働き”と“特徴”

『クレベリン』等の“衛生管理製品”の主成分である二酸化塩素は、特定のアミノ酸のみを酸化し、ごく低濃度でウイルス除去・除菌・消臭に効果を発揮します。

このような二酸化塩素の働きについて、当社研究所では、インフルエンザ等の様々なウイルス・菌を用いて研究を続けています。その研究成果は、“国際的な科学専門誌への論文掲載”や“国内外での学会発表”により世界中の専門家たちに知られるようになり、「様々なウイルスや菌に対して、二酸化塩素が活用出来る」として注目を集めております。

また、二酸化塩素は、日本国内で“浄水（水道水等）処理”や“食品添加物として小麦粉の漂白処理”にも使用が認められている成分です。次亜塩素酸ナトリウムと比べ、有害なトリハロメタンがほとんど発生しないという特徴もあります。

International Journal of Medicine and Medical Sciences Vol. 1(7) pp. 288-289, July, 2009
Available online http://www.academicjournals.org/ijmms

Short Communication

Effect of chlorine dioxide gas of extremely low concentration on absenteeism of schoolchildren

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Accepted 03 July, 2009

Gas-generating devices of chlorine dioxide (ClO_2) are used as deodorant of rooms. We happened to use a commercial tabletop deodorant canister that releases extremely low-concentration ClO_2 gas in a school classroom as deodorant. We found retrospectively and unexpectedly that during a period of 38 consecutive school days the rate of school children absent from the school was markedly lower (1.5%) in a classroom where the ClO_2 device was placed than that (4.0%) in a classroom where it was not placed. The percentages of absenteeism between these classrooms (1.5% vs. 4.0%) were significantly ($p < 0.00001$) different. The predominant causes of absenteeism during the period were common cold and influenza. Judging from the known virucidal activity of ClO_2, our unexpected finding in the school classrooms strongly suggests the usefulness of extremely low-concentration ClO_2 gas to prevent respiratory viral diseases in semi-closed areas, such as theaters, hospitals and aircraft, without necessitating evacuation.

Key words: Chlorine dioxide, absenteeism, schoolchildren, gas, influenza, respiratory infection, virus.

INTRODUCTION

Chorine dioxide (ClO_2) is water-soluble gas at room temperature (Gordon et al., 1972). It has long been used as a disinfectant of tap water (Betancourt and Rose, 2004), bleach (Moran et al., 1953) and deodorant (Loesche and Kazor, 2002). Owing to its strong oxidizing activity, it inactivates bacteria, fungi and viruses (Berg et al., 1982; Morino et al., 2007; Roller et al., 1980; Simonet and Gantzer, 2006). ClO_2 gas released from its aqueous solution has been used as a sanitizer and a deodorant of room air. We used a commercial tabletop deodorant ClO_2 gas-generating device in school classrooms, and noticed an important finding about the absenteeism of school-children. The emerging threat of an influenza pandemic that may be spread rapidly by air travel is currently a serious global concern. The importance of our finding in terms of prevention of the spread of respiratory viral dise-ases, such as high-virulence avian influenza, in semi-closed areas, such as theaters, hospitals and aircraft, is briefly discussed.

MATERIALS AND METHODS

A commercially available tabletop ClO_2 gas-generating device (Cleverin G, a canister of 150 g active ingredients) was used. The ingredients of the device are sodium chlorite ($NaClO_2$), sodium dihydrogenphosphate (NaH_2PO_4), sodium salt of polyacrylic acid and water. The device releases gaseous ClO_2 in a sustained manner. Three of these devices were placed in a classroom with 65-m^2 floor area (230-m^3 volume) and 34 schoolchildren for use as a deodorant. According to the manufacturer, the concentration of ClO_2 becomes 0.01-0.03 ppm in a classroom of this volume when that number of units is used. The data were collected from an elementary school with schoolchildren of 6-12 years old and with almost equal numbers of girls and boys. The statistical evaluation of the difference in the rate of absenteeism between two groups (schoolchildren in classrooms with or without the ClO_2 devices) was done by a χ^2 test, and the difference was considered significant at $p < 0.05$.

RESULTS AND DISCUSSION

When we used the device in a school classroom, we found retrospectively during the period of 38 consecutive school days that the rate of absenteeism (number of absent schoolchildren divided by a nominal number of school children in that particular classroom) during the period of 38 consecutive school days (from January to March) appeared lower in the classroom where the ClO_2 devices were placed compared to that in the classrooms where such devices were not placed (Figure 1). However, it was statistically unclear from Figure 1 whether the

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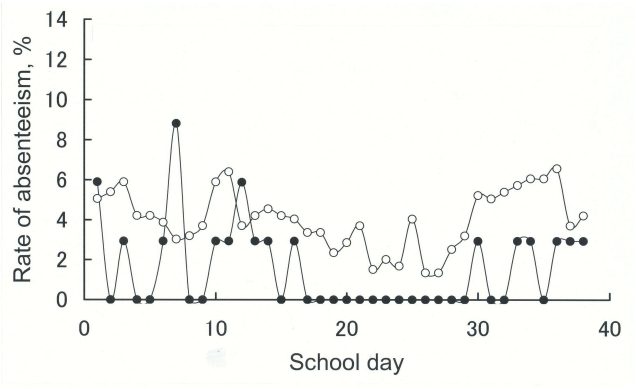

Figure 1. Rates of absenteeism of school children. Rates of absenteeism (number of absent schoolchildren divided by a nominal number of school children in that particular classroom) in classrooms where ClO_2 gas-generating devices (Cleverin G) were (filled circles, one classroom) or were not (open circles, 17 classrooms) placed are shown.

Table 1. Cumulative numbers of schoolchildren present or absent from school.

Cumulative no. of school children		
ClO_2 device	Present	Absent
Placed	1272 (98.5%)	20 (1.5%*)
Not placed	21634 (96.0%)	900 (4.0%*)

Numbers represent cumulative numbers of schoolchildren in classrooms with (one classroom) or without (17 classrooms) ClO_2 devices who were present or absent from school during 38 consecutive school days. *Significantly different ($p < 0.00001$, χ^2 test).

difference in the rate of absenteeism between the two groups was significant. Therefore, we calculated cumulative numbers of schoolchildren present or absent from school based upon the above data by summing up the daily number of schoolchildren present or absent for the entire 38 school days (Table 1).

The rate of absenteeism demonstrated by the cumulative number of schoolchildren absent from school was markedly lower in the classroom where the ClO_2 device was placed than that in the classrooms without the device. In the former classroom, the cumulative number of schoolchildren present was 1272 (98.5%), and that of schoolchildren absent was 20 (1.5%). On the other hand, in the latter classrooms, the cumulative number of schoolchildren present was 21634 (96.0%), and that of schoolchildren absent was 900 (4.0%). The percentages of absenteeism (1.5 vs. 4.0%) were significantly ($p < 0.00001$, χ^2 test) different. This unexpected observation strongly suggests usefulness of the device in preventing infectious, most probably respiratory, diseases in a community. To rigorously prove the effect of low-concentration ClO_2 gas against the occurrence of diseases, it will be needed in a future study to do a crossover study, in which a classroom where a ClO_2 device was placed is studied again without the device with the same population of children.

The effect of the device on the lower rate of absenteeism appears to be due to the ClO_2 gas released from the device, since the only volatile materials released from the device are ClO_2 and water. Respiratory viral diseases, such as high-virulence avian influenza, are major public health concerns worldwide (Ginsberg et al., 2009). Due to the potential for rapid spread of such diseases via air travel, they could immediately result in pandemics with millions of fatalities. However, at present there are almost no effective countermeasures against such devastating infectious diseases in semi-closed areas, such as aircraft, tramcars and school classrooms. Judging from the known virucidal activity of ClO_2 (Zoni et al., 2007), our unexpected and retrospectively observed finding in school suggests the possible usefulness of extremely low-concentration ClO_2 gas to prevent the spread of respiratory viral diseases without necessitating evacuation. Based upon the serendipitous observation in a school, we conclude that ClO_2 gas at an extremely low concentration could potentially prevent diseases, such as respiratory infections, in semi-closed areas. Large-scale prospective studies based upon a solid methodology would be needed to substantiate our important observation.

ACKNOWLEDGMENT

We thank Shigeo Asada for his valuable contribution to this work.

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