

帰国留学生短期研究報告書 (外国人研究者用)

Research Report (Foreign Researcher)

2019 年 8 月 5 日
year month day

首都大学東京学長 殿
Dear President, Tokyo Metropolitan University

| | |
|--------------------------------------|--|
| 外国人研究者氏名 (カタカナまたは漢字) ※パスポートと同一の氏名 | Foreign Researcher (In alphabet) ※Your name as written in your passport |
| | Rajbangshi Subas |
| 受入研究者氏名 (カタカナまたは漢字) | Research Advisor (In alphabet) |
| | Professor Dr. Ken-ichi Sugiura |
| 国 籍 | Nationality |
| | Bangladeshi |
| 所 属 機 関 | Affiliation |
| | Jahangirnagar University, Savar, Dhaka, Bangladesh |
| 職 名 | Position |
| | Associate Professor |
| 研 究 期 間 | Period of Research |
| | 10 th May 2019 to 6 th August 2019 |
| 専 攻 分 野 | Major Field |
| | Chemistry |

| |
|--|
| ①研究課題 / Theme of Research (全角390文字/半角780文字以内) (Within two-bite 390 characters in Japanese/ one-bite 780 letters in English) |
| Chemiluminescence of Axially Chiral Pyrene-Luminol and Their Chiroptical Properties |

②研究概要 / Outline of Research (全角390文字/半角780文字以内)**(Within two-bite 390 characters in Japanese/ one-bite 780 letters in English)**

Chemiluminescence displaying significant roles in the current research of chemistry, because of its extensively used in analytical, biochemical and in forensics for the detection of bloodstains, that is invisible to the naked eye. The chemiluminescence property of luminol was first reported by Albrecht in 1928. When luminol is mixed with an oxidizing agent in aqueous solution, it exhibits a striking blue chemiluminescence, which is catalyzed by iron. For this reason, the visual detection of bloodstains can be detected by spraying a luminol aqueous solution in a darkened environment due to the catalytic effect of the iron-containing heme group. For this reason, we synthesized luminol analogues of axial chiral pyrene with a hope of great interest Chemiluminescence world.

③研究成果 / Results of Research (全角390文字/半角780文字以内)**(Within two-bite 390 characters in Japanese/ one-bite 780 letters in English)**

Axially chiral pyrene-luminol compound was synthesized through a series of reaction starting from 2-hydroxy-7-*tert*-butyl pyrene and 3-methyl phthalic anhydride. The total synthesis procedure was the combination of three different synthetic pathways. In step #1, At first Bromination was carried out on 3-methyl phthalic anhydride, which gave 4-bromo-3-methyl phthalic anhydride. This 4-bromo-3-methyl phthalic anhydride was then converted to 4-bromo-3-methyl *N*-hexyl phthalamide. In step #2, alkylation was performed on 2-hydroxy-7-*tert*-butyl pyrene, that resulted 2-butoxy-7-*tert*-butyl pyrene. Then bromination was carried out on this compound with NBS, that gave only 1-bromo-2-butoxy-7-*tert*-pyrene. Treatment of this compound with bis(pinacolato)diboron in the presence of Pd₂(bda)₃ catalyst gave 1-boronic ester-2-butoxy-7-*tert*-pyrene. In step #3, Suzuki coupling was performed between 4-bromo-3-methyl *N*-hexyl phthalamide and 1-boronic ester-2-butoxy-7-*tert*-pyrene with Pd(dppf)Cl₂.CH₂Cl₂ catalyst, that resulted pyrene phthalamide compound. In the final step, treatment of pyrene phthalamide with

④今後の研究計画 / Further Research Plan (全角390文字/半角780文字以内)**(Within two-bite 390 characters in Japanese/ one-bite 780 letters in English)**

Considering the result obtained from the axially chiral luminol compound, coordinated by 4-bromo-3-methyl *N*-hexyl phthalamide and 1-boronic ester-2-butoxy-7-*tert*-pyrene, we are now interested to investigate the CPL properties of new axially chiral compound. For these purposes, we will try to separate the (R) and (S) enantiomer of this compound. We will also measure the CD spectra of this compound. We will also observe the chemiluminescence properties of this compound. We hope that this new complexes will introduce new properties, which will expand the new research on chemiluminescence chemistry.

⑤東京と海外諸都市との相互理解・友好親善関係の推進についての展望 / Vision for Contribution of Strength of Mutual Understanding/Friendship Between Tokyo and International Cities (全角390文字/半角780文字以内) (Within two-bite 390 characters in Japanese/ one-bite 780 letters in English)

The follow-up research fellowship offered by the Tokyo Metropolitan University will develop new the research field on the home country of the foreign researchers. The research knowledge, that I obtained during this period will help my institution to build up a new research area in this field. My home University is Jahangirnagar University, Dhaka, Bangladesh. From this research our University student will learn know knowledge about the axial chirality and luminol chemistry. I think they will be interested in this field and will do more research in this field, which will help us to develop our University as well as develop our country because our University is a leading University in Bangladesh. Moreover, Japan is the best friend of Bangladesh, that has kept touch in most of the development of Bangladesh. Through the fellowship offered by Tokyo Metropolitan Government and by Japan Government, most of the Bangladeshi get the opportunity to get their higher study from Japan. In this way it has already made a mutual understanding between the Tokyo and the Dhaka, Bangladesh.

帰国留学生短期研究報告書 (受入研究者用)

Research Report (Research Advisor)

2019 年 8 月 7 日
year month day首都大学東京学長 殿
Dear President, Tokyo Metropolitan University

| 受入研究者氏名 (カタカナまたは漢字) | Research Advisor (In alphabet) |
|----------------------|----------------------------------|
| 杉浦健一 | Ken-ichi Sugiura |
| 職名 | Position |
| 教授 | Professor |
| 受入研究科名 | Graduate School |
| 理学研究科 | Graduate School of Science |
| 外国人研究者氏名 (カタカナまたは漢字) | Foreign Researcher (In alphabet) |
| シャヘッド・ラナ | Shahed Rana |
| 国 籍 | Nationality |
| バングラデシュ人民共和国 | Bangladesh |
| 所 属 機 関 | Affiliation |
| ジャハングルナガル大学 | Jahangirnagar University |
| 研 究 期 間 | Period of Research |
| 2019年5月10日～2019年8月6日 | 2019/5/10-2019/8/6 |
| 専 攻 分 野 | Major Field |
| 合成化学 | synthetic chemistry |

※以下の点に注意の上、受入研究者の立場で報告してください。

- ①研究指導概要：外国人研究者にどのような研究指導をしたか。
- ②研究指導成果：今回の研究で外国人研究者にどのような成果が見えたか。
- ③今後の計画：今後、指導者としてどのように交流をとりながら研究をすすめていくか。

①研究概要 / Outline of Research (全角390文字/半角780文字以内)

近年、不斉な化合物の分光挙動に興味を持たれている。一方、蛍に代表される生物の発光現象には、不斉な蛍光色素が関与していることが知られている。そこで、本研究では、受け入れ研究者が以前に合成したビピレノールを化学発光の手段によって光らせる実験の計画を指導した。

②研究成果 / Results of Research (全角390文字/半角780文字以内)

具体的には、代表的な化学発光物質であるルミノールに着目し、これにビピレノールを連結させることを計画した。両者を結合させるためには鈴木カップリング反応を用いた。具体的には、ビピレノールの方にボロン酸を、ルミノールの方にハロゲンを導入し反応を行った。得られた化合物は分光学的に同定した。定性的に発光挙動を評価したところ、目視で光を発することを確認することができた。

③今後の計画 / Further Research Plan (全角390文字/半角780文字以内)

帰国後、必要なデータを収収し、論文発表の準備を行っている。

首都大学東京帰国留学生短期研究支援制度 平成30年度 研究報告書

<外国人研究者プロフィール/Profile>

| | |
|--------------------|--------------------------|
| 外国人研究者 | シャヘッド・ラナ |
| Foreign Researcher | Shahed Rana |
| 国 籍 | バングラデシュ人民共和国 |
| Nationality | Bangladesh |
| 所属機関 | ジャハングルナガル大学 |
| Affiliation | Jahangirnagar University |
| 現在の職名 | |
| Position | Associate Professor |
| 研究期間 | 2019年5月10日～2019年8月6日 |
| Period of Stay | 2019/5/10-2019/8/6 |
| 専攻分野 | 合成化学 |
| Major Field | synthetic chemistry |



写真タイトル 日/英

| | | | |
|----------------------------|----------------------------|----------|-----------|
| 受入研究者 | 杉浦健一 | 職名 | 教授 |
| Research Advisor | Ken-ichi Sugiura | Position | Professor |
| 受入研究科 | 理学研究科 | | |
| Graduate School/Department | Graduate School of Science | | |

<外国人研究者からの報告/Foreign Researcher Report>

| | |
|--|--|
| ①研究課題 / Theme of Research | |
| Chemiluminescence of Axially Chiral Pyrene-Luminol and Their Chiroptical Properties | |
| ②研究概要 / Outline of Research | |
| Chemiluminescence displaying significant roles in the current research of chemistry, because of its extensively used in analytical, biochemical and in forensics for the detection of bloodstains, that is invisible to the naked eye. The chemiluminescence property of luminol was first reported by Albrecht in 1928. When luminol is mixed with an oxidizing agent in aqueous solution, it exhibits a striking blue chemiluminescence, which is catalyzed by iron. For this reason, the visual detection of bloodstains can be detected by spraying a luminol aqueous solution in a darkened environment due to the catalytic effect of the iron-containing heme group. For this reason, we synthesized luminol analogues of axial chiral pyrene with a hope of great interest Chemiluminescence world. | |
| ③研究成果 / Results of Research | |
| Axially chiral pyrene-luminol compound was synthesized through a series of reaction starting from 2-hydroxy-7-tert-butyl pyrene and 3-methyl phthalic anhydride. The total synthesis procedure was the combination of three different synthetic pathways. In step #1, At first Bromination was carried out on 3-methyl phthalic anhydride, which gave 4-bromo-3-methyl phthalic anhydride. This 4-bromo-3-methyl phthalic anhydride was then converted to 4-bromo-3-methyl N-hexyl phthalamide. In step #2, alkylation was performed on 2-hydroxy-7-tert-butyl pyrene, that resulted 2-butoxy-7-tert-butyl pyrene. Then bromination was carried out on this compound with NBS, that gave only 1-bromo-2-butoxy-7-tert-pyrene. Treatment of this compound with bis(pinacolato)diboron in the presence of Pd2(bda)3 catalyst gave 1-boronic ester-2-butoxy-7-tert-pyrene. In step #3, Suzuki coupling was performed between 4-bromo-3-methyl N-hexyl phthalamide and 1-boronic ester-2-butoxy-7-tert-pyrene with Pd(dppf)Cl2·CH2Cl2 catalyst, that resulted pyrene phthalamide compound. In the final step, treatment of pyrene phthalamide with hydrazine afforded the target axially chiral pyrene-luminol compound. | |
| ④今後の計画 / Further Research Plan | |
| Considering the result obtained from the axially chiral luminol compound, coordinated by 4-bromo-3-methyl N-hexyl phthalamide and 1-boronic ester-2-butoxy-7-tert-pyrene, we are now interested to investigate the CPL properties of new axially chiral compound. For these purposes, we will try to separate the (R) and (S) enantiomer of this compound. We will also measure the CD spectra of this compound. We will also observe the chemiluminescence properties of this compound. We hope that this new complexes will introduce new properties, which will expand the new research on chemiluminescence chemistry. | |
| ⑤東京と海外諸都市との相互理解・友好親善関係の推進についての計画 / Further Plan of Contribution of Strength of Mutual Understanding/Friendship Between Tokyo and International cities | |
| The follow-up research fellowship offered by the Tokyo Metropolitan University will develop new the research field on the home country of the foreign researchers. The research knowledge, that I obtained during this period will help my institution to build up a new research area in this field. My home University is Jahangirnagar University, Dhaka, Bangladesh. From this research our University student will learn know knowledge about the axial chirality and luminol chemistry. I think they will be interested in this field and will do more research in this field, which will help us to develop our University as well as develop our country because our University is a leading University in Bangladesh. Moreover, Japan is the best friend of Bangladesh, that has kept touch in most of the development of Bangladesh. Through the fellowship offered by Tokyo Metropolitan Government and by Japan Government, most of the Bangladeshi get the opportunity to get their higher | |

<受入研究者からの報告/Research Advisor Report>

①研究概要 / Outline of Research

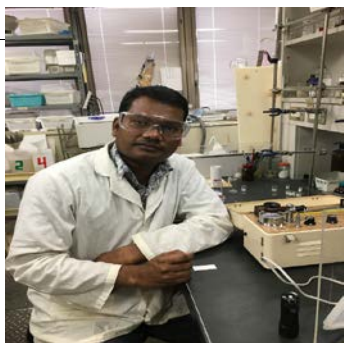
近年、不斉な化合物の分光挙動に興味が持たれている。一方、蛍に代表される生物の発光現象には、不斉な蛍光色素が関与していることが知られている。そこで、本研究では、受け入れ研究者が以前に合成したビピレノールを化学発光の手段によって光らせる実験の計画を指導した。

②研究成果 / Results of Research

具体的には、代表的な化学発光物質であるルミノールに着目し、これにビピレノールを連結させることを計画した。両者を結合させるためには鈴木カップリング反応を用いた。具体的には、ビピレノールの方にボロン酸を、ルミノールの方にハロゲンを導入し反応を行った。得られた化合物は分光学的に同定した。定性的に発光挙動を評価したところ、目視で光を発することを確認することができた。

③今後の計画 / Further Research Plan

帰国後、必要なデータを収取し、論文発表の準備を行っている。



写真タイトル 日/英

写真貼り付け

写真タイトル 日/英