# การสังเคราะห์และฤทธิ์กำจัดวัชพืชของกรดซินนามิกและสารประกอบที่เกี่ยวข้อง


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# SYNTHESIS AND HERBICIDAL ACTIVITY OF CINNAMIC ACID AND RELATED COMPOUNDS

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สังเคราะห์สารในกลุ่มกรดซินนามิกสี่สิบเจ็ดชนิดโดยอาศัยปฏิกิริยาคอนเดนเซชันระหว่างกรดมาโลนิกกับแอลดีไฮด์ นำสารที่ได้ไปทดสอบฤทธิ์ยับยั้งการเจริญเติบโตของไมยราบยักษ์ (*Mimosa pigra* Linn.) และหญ้าข้าวนก (*Echinochloa crus-galli* Beauv.) พบว่ากรดซินนามิกแปดชนิดที่มีหมู่แทนที่เป็น 3-ฟลูออโร, 3-คลอโร, 2,6-ไดคลอโร, 2-คลอโร-6-ฟลูออโร, 3-เมทอกซี, 4-เมทอกซี, 3,4-เมทิลลีนไดออกซี และ 3-ไนโตร สามารถยับยั้งการเจริญเติบโตของไมยราบยักษ์ได้ดี และกรดซินนามิกสิบเอ็ดชนิดที่มีหมู่แทนที่เป็น 4-ฟลูออโร, 2-คลอโร, 4-คลอโร, 2-, 3- และ 4-โบรโม, 2,4-, 2,6- และ 3,4-ไดคลอโร, 4-เมทอกซี และ 4-เทอชีรีบิวทิล แสดงฤทธิ์การยับยั้งการเจริญเติบโตของหญ้าข้าวนกได้ดี นอกจากนี้ ได้สังเคราะห์ซินนามามีดสิบสองชนิด, ซินนาเมดเอสเทอร์สิบห้าชนิด, เกลือโซเดียมซินนาเมดหกชนิด และเกลือแคลเซียมซินนาเมดสามชนิด แล้วนำไปทดสอบฤทธิ์การยับยั้งการเจริญเติบโตของไมยราบยักษ์ พบว่า เอ็น-2,4-ไดคลอโรฟีนิล 3,4-เมทิลลีนไดออกซีซินนามีด, 2,4-ไดคลอโรฟีนิล 3-ไนโตรซินนาเมด, โซเดียม 3-ฟลูออโรซินนาเมด, โซเดียม 3-คลอโรซินนาเมด, โซเดียม 3-เมทอกซีซินนาเมด, โซเดียม 3-ไนโตรซินนาเมด, โซเดียม 3,4-เมทิลลีนไดออกซินนาเมด, แคลเซียม 3-ฟลูออโรซินนาเมด และ แคลเซียม 3,4-เมทิลลีนไดออกซีซินนาเมด แสดงฤทธิ์การยับยั้งที่ดี นอกจากนี้พบว่า กรด 3,4-เมทิลลีนไดออกซีซินนามิก และ 3-ไนโตรซินนามิก ไม่แสดงฤทธิ์การยับยั้งการงอกของพืชทดสอบ สารหลายชนิดแสดงฤทธิ์เทียบเคียงได้กับสารกำจัดวัชพืชที่ใช้ในทางการเกษตรในปัจจุบัน สารดังกล่าวนี้มีศักยภาพที่จะพัฒนาเป็นสารกำจัดวัชพืชชนิดใหม่ต่อไป

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Forty-seven substituted *trans*-cinnamic acids were synthesized by the condensation reaction between malonic acid and selected aldehydes. The inhibitory effect of these well-characterized compounds were tested with *Mimosa pigra* Linn. and *Echinochloa crus-galli* (L.) Beauv. The eight *trans*-cinnamic acids bearing, 3-F, 3-Cl, 2,6-diCl, 2-Cl-6-F, 3-OMe, 4-OMe, 3,4-$OCH_2O$- and 3-$NO_2$ showed high inhibitory effect on growth of *M. pigra*. While the eleven *trans*-cinnamic acids containing 4-F, 2-Cl, 4-Cl, 2-, 3- and 4-Br, 2,4-, 2,6- and 3,4-diCl, 4-OMe and 4-*t*-$C_4H_9$ showed high inhibitory effect on growth of *E. crus-galli*. In addition, twelve cinnamamides, fifteen cinnamate esters, six sodium cinnamate and three calcium cinnamate derivatives were prepared. These well-characterized compounds were tested for antigrowth activity of *M. pigra*. *N*-(2,4-dichlorophenyl)-3,4-methylenedioxycinnamamide, 2,4-dichlorophenyl 3-nitro-cinnamate, sodium 3-fluorocinnamate, sodium 3-chlorocinnamate, sodium 3-methoxy-cinnamate, sodium 3-nitrocinnamate, sodium 3,4-methylenedioxycinnamate, calcium 3-fluorocinnamate and calcium 3,4-methylenedioxycinnamate exhibited high activities. Besides, 3,4-methylenedioxycinnamic and 3-nitrocinnamic acids did not show germination inhibition activity against selected weeds. Several compounds displayed the activity comparable to various commercial herbicides in terms of growth inhibition activity test. Some of them revealed promising tendency for the development as new herbicides.

Department.....Chemistry.....Student's signature.....Sujittra Deesamer.....

Field of study .....Chemistry.....Advisor's signature.....Warinthorn Chavasiri.....

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## List of Abbreviations

| | | | |
|---|---|---|---|
| br | broad | mm | millimeter |
| °C | degree Celsius | m.p. | melting point |
| $cm^{-1}$ | unit of wavenumber | MS | mass spectroscopy |
| Cpd | compound | *m/z* | mass per charge |
| d | doublet (NMR) | NMR | nuclear magnetic resonance |
| dd | doublet of doublet (NMR) | ppm | part per million |
| DMSO | dimethylsulfoxide | q | quartet (NMR) |
| g | gram (s) | rel. int. | relative intensity |
| h | heptet (NMR) | $R_f$ | retardation factor |
| Hz | hertz | s | strong (IR) |
| IR | infrared | s | singlet (NMR) |
| J | coupling constant | t | triplet (NMR) |
| lit | literature | w | weak (IR) |
| m | multiplet (NMR) | wt | weight |
| m | medium (IR) | δ | chemical shift |
| mL | milliliter (s) | % | percent |