Synthesis of gypsogenin and gypsogenic acid derivatives with antitumor activity by damaging cell membranes

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Supporting Information

Contents

IR(KBr) of compounds 3-14d .................................................................................................................. 25
Mass spectra of compounds 3-14d ........................................................................................................ 41
1H NMR(600 MHz) of compounds 3-14d ............................................................................................ 63
13C NMR(150 MHz) of compounds 3-14d ............................................................................................ 63
IR(KBr) of compounds 3-14d

For compound 3, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 4a, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 4b, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 4c, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 4d, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 4e, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 4f, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 5a, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 5b, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 5c, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 5d, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 5e, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 6a, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 6b, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 6c, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 6d, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 6e, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 6f, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 6g, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 6h, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 6i, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 6j, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 6k, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 7, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 7a, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 7b, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 7c, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 7d, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 7e, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 8, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 8a, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 8b, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 8c, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 8d, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 8e, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 8f, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 9, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 10, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 11, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 12, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 13, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound 14a, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound 14b, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
For compound **14c**, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:

For compound **14d**, IR spectra were recorded on a Thermo Nicolet Nexus 670 FT-IR spectrometer:
Mass spectra of compounds 3-14d

ESI mass spectrum of compound 3 recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 4a recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 4b recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 4c recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 4d recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 4e recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 4f recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 5a recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 5b recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 5c recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 5d recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 5e recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 6a recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 6b recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 6c recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 6d recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 6e recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 6f recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 6g recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 6h recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 6i recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 6j recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 6k recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 7 recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 7a recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 7b recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 7c recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 7d recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 7e recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 8 recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 8a recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 8b recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 8c recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 8d recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 8e recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 8f recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 9 recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 10 recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 11 recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 12 recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 13 recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 14a recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 14b recorded on an AGILENT 1200 Capillary spectrometer:
ESI mass spectrum of compound 14c recorded on an AGILENT 1200 Capillary spectrometer:

ESI mass spectrum of compound 14d recorded on an AGILENT 1200 Capillary spectrometer:

$^{1}$H NMR (600MHz) of compounds 3-14d

$^{1}$H NMR (600MHz) of compound 3 recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
1H NMR (600MHz) of compound 4a recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d₅):

1H NMR (600MHz) of compound 4b recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d₅):
$^{1}H$ NMR (600MHz) of compound 4c recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

$^{1}H$ NMR (600MHz) of compound 4d recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
1H NMR (600MHz) of compound 4e recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

1H NMR (600MHz) of compound 4f recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
1H NMR (600MHz) of compound 5a recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d₅):

1H NMR (600MHz) of compound 5b recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d₅):
1H NMR (600MHz) of compound 5c recorded on a Bruker Avance III 600 spectrometer (600MHz,pyridine-d$_5$):

1H NMR (600MHz) of compound 5d recorded on a Bruker Avance III 600 spectrometer (600MHz,pyridine-d$_5$):
$^1$H NMR (600MHz) of compound 5e recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$)

$^1$H NMR (600MHz) of compound 6a recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
1H NMR (600MHz) of compound 6b recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

1H NMR (600MHz) of compound 6c recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
1H NMR (600MHz) of compound 6d recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

1H NMR (600MHz) of compound 6e recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
1H NMR (600MHz) of compound 6f recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d5):

1H NMR (600MHz) of compound 6g recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d5):
1H NMR (600MHz) of compound 6h recorded on a Bruker Avance III 600 spectrometer (600MHz,pyridine-d$_5$):

1H NMR (600MHz) of compound 6i recorded on a Bruker Avance III 600 spectrometer (600MHz,pyridine-d$_5$):
1H NMR (600MHz) of compound 6j recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

1H NMR (600MHz) of compound 6k recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
$^1$H NMR (600MHz) of compound 7 recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

$^1$H NMR (600MHz) of compound 7a recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
$^{1}H$ NMR (600MHz) of compound 7b recorded on a Bruker Avance III 600 spectrometer (600MHz,pyridine-d$_5$):

$^{1}H$ NMR (600MHz) of compound 7c recorded on a Bruker Avance III 600 spectrometer (600MHz,pyridine-d$_5$):
1H NMR (600MHz) of compound 7d recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

1H NMR (600MHz) of compound 7e recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
$^{1}H$ NMR (600MHz) of compound 8 recorded on a Bruker Avance III 600 spectrometer (600MHz,pyridine-$d_5$):

$^{1}H$ NMR (600MHz) of compound 8a recorded on a Bruker Avance III 600 spectrometer (600MHz,pyridine-$d_5$):
1H NMR (600MHz) of compound 8b recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

1H NMR (600MHz) of compound 8c recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
1H NMR (600MHz) of compound 8d recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

1H NMR (600MHz) of compound 8e recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
1H NMR (600MHz) of compound 8f recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d5):

1H NMR (600MHz) of compound 9 recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d5):
1H NMR (600MHz) of compound 10 recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

1H NMR (600MHz) of compound 11 recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
1H NMR (600MHz) of compound 12 recorded on a Bruker Avance Ⅲ 600 spectrometer (600MHz,pyridine-d$_5$):

1H NMR (600MHz) of compound 13 recorded on a Bruker Avance Ⅲ 600 spectrometer (600MHz,pyridine-d$_5$):
1H NMR (600MHz) of compound 14a recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

1H NMR (600MHz) of compound 14b recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
1H NMR (600MHz) of compound 14c recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):

1H NMR (600MHz) of compound 14d recorded on a Bruker Avance III 600 spectrometer (600MHz, pyridine-d$_5$):
$^{13}$C NMR (150MHz) of compounds 3-14d

$^{13}$C NMR (600MHz) of compound 3 recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 4a recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 4b recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 4c recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 4d recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 4e recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 4f recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d$_5$):

$^{13}$C NMR (600MHz) of compound 5a recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d$_5$):
$^{13}$C NMR (600MHz) of compound 5b recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 5c recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 5d recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 5e recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 6a recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 6b recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 6c recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 6d recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 6e recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 6f recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 6g recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 6h recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600 MHz) of compound 6i recorded on a Bruker Avance III 600 spectrometer (150 MHz, pyridine-d5):

$^{13}$C NMR (600 MHz) of compound 6j recorded on a Bruker Avance III 600 spectrometer (150 MHz, pyridine-d5):
\(^{13}\)C NMR (600MHz) of compound 6k recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

\(^{13}\)C NMR (600MHz) of compound 7 recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 7a recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 7b recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
\(^{13}\text{C} \text{NMR} \ (600\text{MHz})\) of compound 7c recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

\(^{13}\text{C} \text{NMR} \ (600\text{MHz})\) of compound 7d recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 7e recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 8 recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
\(^{13}\)C NMR (600MHz) of compound 8a recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

\(^{13}\)C NMR (600MHz) of compound 8b recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 8c recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 8d recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 8e recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 8f recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 9 recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 10 recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 11 recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d$_5$):

$^{13}$C NMR (600MHz) of compound 12 recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d$_5$):
$^{13}$C NMR (600MHz) of compound 13 recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 14a recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600MHz) of compound 14b recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):

$^{13}$C NMR (600MHz) of compound 14c recorded on a Bruker Avance III 600 spectrometer (150MHz, pyridine-d5):
$^{13}$C NMR (600 MHz) of compound 14d recorded on a Bruker Avance III 600 spectrometer (150 MHz, pyridine-$d_5$):

HSQC, HMBC spectrum of compound 4a

HSQC of compound 4a recorded on a Bruker Avance III 600 spectrometer (pyridine-$d_5$):
HMBC of compound 4a recorded on a Bruker Avance III 600 spectrometer (pyridine-d$_5$):

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86