Supporting information

Synthesis of novel heterocyclic oleanolic acid derivatives with improved antiproliferative activity in solid tumor cells

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1. Spectral data for compound 15

$^1$H NMR spectrum for compound 15 recorded in CDCl$_3$. 
$^{13}$C NMR spectrum for compound 15 recorded in CDCl$_3$. 

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$^{13}$C NMR spectrum detail of compound 15.
DEPT-135 NMR spectrum for compound 15 recorded in CDCl₃
2. Spectral data for compound 16

$^1$H NMR spectrum for compound 16 recorded in CDCl$_3$. 

![NMR Spectrum Image]

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$^{13}$C NMR spectrum for compound 16 recorded in CDCl$_3$. 

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\(^{13}\)C NMR spectrum detail of compound 16.
DEPT-135 NMR spectrum for compound 16 recorded in CDCl₃.
HMOC NMR spectrum for compound 16 recorded in CDCl$_3$. 
HMBC NMR spectrum for compound 16 recorded in CDCl₃.
3. Spectral data for compound 17

$^1$H NMR spectrum for compound 17 recorded in CDCl$_3$. 

![NMR spectrum image]
$^{13}$C NMR spectrum for compound 17 recorded in CDCl$_3$. 

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$^{13}$C NMR spectrum detail of compound 17.
DEPT-135 NMR spectrum for compound 17 recorded in CDCl₃.
HMQC NMR spectrum for compound 17 recorded in CDCl₃.
HMBC NMR spectrum for compound 17 recorded in CDCl₃.
4. Spectral data for compound 18

$^1$H NMR spectrum for compound 18 recorded in CDCl$_3$. 

![NMR Spectrum Image]
$^1$H NMR spectrum for compound 18 recorded in CDCl$_3$. 

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$^{13}$C NMR spectrum detail of compound 18.
DEPT-135 NMR spectrum for compound 18 recorded in CDCl$_3$. 
HMOC NMR spectrum for compound 18 recorded in CDCl$_3$. 

![HMOC NMR spectrum](image-url)
HMBC NMR spectrum for compound 18 recorded in CDCl₃.
5. Spectral data for compound 19

$^1$H NMR spectrum for compound 19 recorded in CDCl$_3$. 

![NMR Spectrum](image)
$^{13}$C NMR spectrum for compound 19 recorded in CDCl$_3$. 
$^{13}$C NMR spectrum detail of compound 19.
DEPT-135 NMR spectrum for compound 19 recorded in CDCl₃.
6. Spectral data for compound 20

$^1$H NMR spectrum for compound 20 recorded in CDCl$_3$. 

![NMR Spectrum Image]
\(^{13}\)C NMR spectrum for compound 20 recorded in CDCl\(_3\).
$^{13}$C NMR spectrum detail of compound 20.
DEPT-135 NMR spectrum for compound 20 recorded in CDCl$_3$. 

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HMOC NMR spectrum for compound 20 recorded in CDCl$_3$. 

[Image of NMR spectrum]
HMBC NMR spectrum for compound 20 recorded in CDCl$_3$. 
7. Spectral data for compound 21

\(^1\)H NMR spectrum for compound 21 recorded in CDCl₃.
$^{13}$C NMR spectrum for compound 21 recorded in CDCl$_3$. 

![Carbon-13 NMR Spectrum](image)
$^{13}$C NMR spectrum detail of compound 21.
DEPT-135 NMR spectrum for compound 21 recorded in CDCl₃.
HMOC NMR spectrum for compound 21 recorded in CDCl$_3$. 

![HMOC NMR Spectrum](image_url)
HMBC NMR spectrum for compound 21 recorded in CDCl₃.
8. Spectral data for compound 22

$^1$H NMR spectrum for compound 22 recorded in CDCl$_3$. 
$^{13}$C NMR spectrum for compound 22 recorded in CDCl$_3$. 

![NMR Spectrum Image]
$^{13}$C NMR spectrum detail of compound 22.
DEPT-135 NMR spectrum for compound 22 recorded in CDCl₃.
9. Spectral data for compound 23

$^{1}$H NMR spectrum for compound 23 recorded in CDCl$_3$. 

![NMR Spectrum Image]
$^{13}$C NMR spectrum for compound 23 recorded in CDCl$_3$. 
$^{13}$C NMR spectrum detail of compound 23.
DEPT-135 NMR spectrum for compound 23 recorded in CDCl₃.
10. Spectral data for compound 24

$^1$H NMR spectrum for compound 24 recorded in CDCl$_3$. 

![NMR Spectrum](image)
$^{13}$C NMR spectrum for compound 24 recorded in CDCl$_3$. 

![Chemical structure and NMR spectrum]
$^{13}$C NMR spectrum detail of compound 24.
DEPT-135 NMR spectrum for compound 24 recorded in CDCl$_3$. 

![DEPT-135 NMR spectrum](image)
11. Spectral data for compound 25

$^1$H NMR spectrum for compound 25 recorded in CDCl$_3$. 

![NMR Spectrum](image)
$^{13}$C NMR spectrum for compound 25 recorded in CDCl$_3$. 
$^{13}$C NMR spectrum detail of compound 25.
DEPT-135 NMR spectrum for compound 25 recorded in CDCl$_3$. 
11. Spectral data for compound 26

$^1$H NMR spectrum for compound 26 recorded in CDCl$_3$. 
$^{13}$C NMR spectrum for compound 26 recorded in CDCl$_3$. 
$^{13}$C NMR spectrum detail of compound 26.
DEPT-135 NMR spectrum for compound 26 recorded in CDCl₃.
HMOC NMR spectrum for compound 26 recorded in CDCl$_3$. 
HMBC NMR spectrum for compound 26 recorded in CDCl₃.
13. Spectral data for compound 27

$^1$H NMR spectrum for compound 27 recorded in CDCl$_3$. 
$^{13}$C NMR spectrum for compound 27 recorded in CDCl$_3$. 

![NMR Spectrum Image]
$^{13}$C NMR spectrum detail of compound 27.
DEPT-135 NMR spectrum for compound 27 recorded in CDCl₃.
HMQC NMR spectrum for compound 27 recorded in CDCl$_3$. 
HMBC NMR spectrum for compound 27 recorded in CDCl$_3$. 

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14. Spectral data for compound 28

$^1$H NMR spectrum for compound 28 recorded in CDCl$_3$. 
$^{13}$C NMR spectrum for compound 28 recorded in CDCl$_3$. 
$^{13}$C NMR spectrum detail of compound 28.
DEPT-135 NMR spectrum for compound 28 recorded in CDCl$_3$. 

![Chemical structure image]
HMQC NMR spectrum for compound 28 recorded in CDCl₃.
HMBC NMR spectrum for compound 28 recorded in CDCl₃.